# Radar Interface Module - RIM782

## User Manual

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# Table of Contents


1. Technical Manual RIM782 ..... 10

1.1. General Introduction ..... 10

1.2. Hardware Description ..... 11

1.2.1. Block Diagram ..... 11
1.2.2. Connectors ..... 11
1.2.2.1. Video Board ..... 12
1.2.2.2. USB Data Recorder (UDR) ..... 13
1.2.2.3. Global Positioning System (GPS450) ..... 16

2. Downlink Measurement ..... 17

2.1. Theory ..... 17

2.2. Software ..... 17

2.2.1. Getting Started ..... 17
2.2.2. Making a Recording ..... 18
2.2.3. Analysis ..... 20
2.2.4. View HPD Logfiles ..... 20
2.2.5. User Defined OTD Limits ..... 22

3. Sectorial Video Recording ..... 24

3.1. Theory ..... 24

3.2. Software ..... 24

3.2.1. Getting Started ..... 24
3.2.2. Making a Recording ..... 25
3.2.3. Advanced Settings ..... 26
3.2.3.1. Graph Palette: Zoom/Select function ..... 26
3.2.3.2. General Settings ..... 27
3.2.3.3. Display Settings ..... 28

3.3. Analysis: Sectorial SSR Video Viewer ..... 29

3.3.1. Introduction ..... 29
3.3.2. Getting Started ..... 29
3.3.3. Sectorial Video Viewer ..... 30
3.3.4. Advanced Settings ..... 31
3.3.5. Different Viewing Modes/Processing/Analysis Methods ..... 32
3.3.5.1. X Window – X Video View/Y Video View ..... 32
3.3.5.2. X Window – Interrogation View ..... 33
3.3.5.3. Y Window – Y Video View ..... 33
3.3.5.4. Y Window- Reply View ..... 34

4. Sectorial Extractor ..... 35

4.1. Theory ..... 35

4.2. Software ..... 35

4.2.1. Getting Started ..... 35

4.2.2. Sectorial Extractor Software....36

5. Data Recording using the RIM782....39

5.1. Introduction....39

5.2. Recording Software....39

5.2.1. Getting Started....39
5.2.2. Making a Recording....40

5.3. Conversion Software....42

5.3.1. Convert Bit Recording....42
5.3.1.1. Single Conversion....43
5.3.1.2. Batch Conversion....45
5.3.2. Convert Data Recording....46
5.3.2.1. Single Conversion....46
5.3.2.2. Batch Conversion....47

6. Data Analysis....47

7. Annexes....48

7.1. Annex 1: Critical Parameters of SSR Antennas....48

7.2. Annex 2: Downlink Connection Diagram....49

7.3. Annex 3: Sectorial Video Recording Connection Diagram....50

7.4. Annex 4: Sectorial Video Mode-S Recording Connection Diagram....51

7.5. Annex 5: RIM782 Data Recording Connection Diagram....52

7.6. Annex 6: Configuration List: RIM782....53

# Table of Figures

*Figure 1: Block Diagram RIM782....11*
*Figure 2: Rear panel RIM782 – Video Board connectors....12*
*Figure 3: Rear panel RIM782 – UDR connectors....14*
*Figure 4: Downlink software....17*
*Figure 5: Load Receiver calibration file window....18*
*Figure 6: Scope Window....18*
*Figure 7: Downlink example of Didactical Test Interrogator....19*
*Figure 8: Downlink HPD example....20*
*Figure 9: Layer tabs and selectors....21*
*Figure 10: Antenna diagram data in TAB-separated file....21*
*Figure 11: Calculate OTD Parameters window....22*
*Figure 12: OTD Definition File....22*
*Figure 13: Make Default File checkbox....22*
*Figure 14: Sectorial Video Recorder software....24*
*Figure 15: Sector settings....25*
*Figure 16: Recording settings....25*
*Figure 17: Example sectorial recording of scenario....26*
*Figure 18: General Settings window....27*
*Figure 19: Display Settings window....28*
*Figure 20: Sectorial Video Viewer - example....30*
*Figure 21: X Video View....32*
*Figure 22: Y Video View in X window....32*
*Figure 23: Interrogation View....33*
*Figure 24: Y Video Display....33*
*Figure 25: Reply data extracted from video....34*
*Figure 26: Sectorial Extractor software....36*
*Figure 27: Source Folder Info....36*
*Figure 28: Destination Folder Info....37*
*Figure 29: Load Rx Calibration File window....37*
*Figure 30: Preview Window....38*
*Figure 31: Converting Sectorial Recording to Pulses....38*
*Figure 32: UDR Control software....39*
*Figure 33: UDR Control software....40*
*Figure 34: UDR Recording....42*
*Figure 35: Convert Bit Recording software....43*
*Figure 36: PPI Display....44*
*Figure 37: Hexadecimal display of converted data....45*
*Figure 38: Batch Process section of Convert software....45*
*Figure 39: Convert Radar Data software....46*
*Figure 40: Hexadecimal display of converted data....47*
*Figure 41: Downlink Connection Diagram....49*
*Figure 42: Sectorial Video Recording Connection Diagram....50*
*Figure 43: Sectorial Video Mode-S Recording Connection Diagram....51*
*Figure 44: RIM782 Data Recording Connection Diagram....52*

# Table of Tables

*Table 1: Video Board Connectors....12*
*Table 2: Differential ACP/ARP DB9 connectors pin layout....12*
*Table 3: RASS DB15HD connector pin layout....13*
*Table 4: UDR Connectors....14*
*Table 5: Serial Data 1/2 DB15 connectors pin layout....15*
*Table 6: RS 232 C Receivers (compatible with RS232C standard)....15*
*Table 7: RS 232 C Drivers (compatible with RS232C standard)....15*
*Table 8: RS422 Receivers (compatible with RS422 standard)....15*
*Table 9: RS422 Drivers (compatible with RS422 standard)....15*
*Table 10: GPS Connectors....16*
*Table 11: Zoom/select functions sector recording....26*

## Conventions Used

***Note: This icon to the left of bold italicized text denotes a note, which alerts you to important information.***

***Caution: This icon to the left of bold italicized text denotes a caution, which alerts you to the possibility of data loss or a system crash.***

***Warning: This icon to the left of bold italicized text denotes a warning, which alerts you to t he possibility of damage to you or your equipment.***

# Glossary of Terms

| | |
|---|---|
| **ACP** | Azimuth Change Pulse |
| **ARP** | Azimuth Reference Pulse |
| **ATC** | Air Traffic Control |
| **CPU** | Computer Processing Unit |
| **CW** | Continuous wave |
| **dB** | Decibel |
| **Downlink** | The signal path from aircraft to ground |
| **FRUIT** | False Replies Unsynchronized In Time, unwanted SSR replies received by an interrogator which have been triggered by other interrogators |
| **GPS** | Global Positioning System |
| **HPD** | Horizontal Polar Diagram |
| **IE** | Intersoft Electronics |
| **IF** | Intermediate Frequency |
| **I/O** | Input/Output |
| **LAN** | Local Area Network |
| **LVA** | Large Vertical Aperture (antenna) |
| **Monopulse** | Radar-receiving processing technique used to provide a precise bearing measurement |
| **MSSR** | Monopulse Secondary Surveillance Radar |
| **OTD** | Out of Tolerance Detection |
| **Plot extractor** | Signal-processing equipment which converts receiver video into digital target reports suitable for transmission by land lines |
| **PPI** | Plan Position Indicator |
| **PRF** | Pulse Repetition Frequency |
| **PSR** | Primary Surveillance Radar |
| **Radar** | Radio Detection And Ranging |
| **Radome** | Radio-transparent window used to protect an antenna principally against the effects of weather |
| **RASS-R** | Radar Analysis Support Systems – Real-time measurements |
| **RASS-S** | Radar Analysis Support Systems – Site measurements |
| **RF** | Radio Frequency |
| **RTQC** | Real Time Quality Control |
| **RX** | Receiver |
| **SLS** | Side Lobe Suppression, a technique to avoid eliciting transponder replies in response to interrogations transmitted via antenna sidelobes |
| **SSR** | Secondary Surveillance Radar |
| **STC** | Sensitivity Time Control |
| **Uplink** | Ground-to-air signal path |

# 1. Technical Manual RIM782

## 1.1. General Introduction

The ***Radar Interface Module RIM782*** can be divided in two parallel running systems: data recorder and video recorder. The RIM782 contains all the necessary hardware to digitize the radar video and/or data, and provide this data to the PC over a standard USB interface.

The video recorder functionality of the hardware interface is performed by 6 video channels, 2 trigger signals and 2 rotation interfaces (ARP-ACP signals both single ended and differential). The RIM782 can sample 2 analog video inputs simultaneously. The digitized video will be sent over a USB connection to a PC (USB Video) and can be used in several RASS-S applications. For instance, the RIM782 can record all types of SSR or Mode S radar video signals using the sectorial recording software.

The data recorder has two bidirectional digital RS232/RS422 synchronous serial data ports for inputting or outputting serial data. The RIM782 can both record and replay data. If more than two channels are required, multiple RIM782s can be "stacked" (or combined with a RDR803). The additional inputs azimuth and time (GPS450) make it a real radar evaluation tool.

## 1.2. Hardware Description

### 1.2.1. Block Diagram

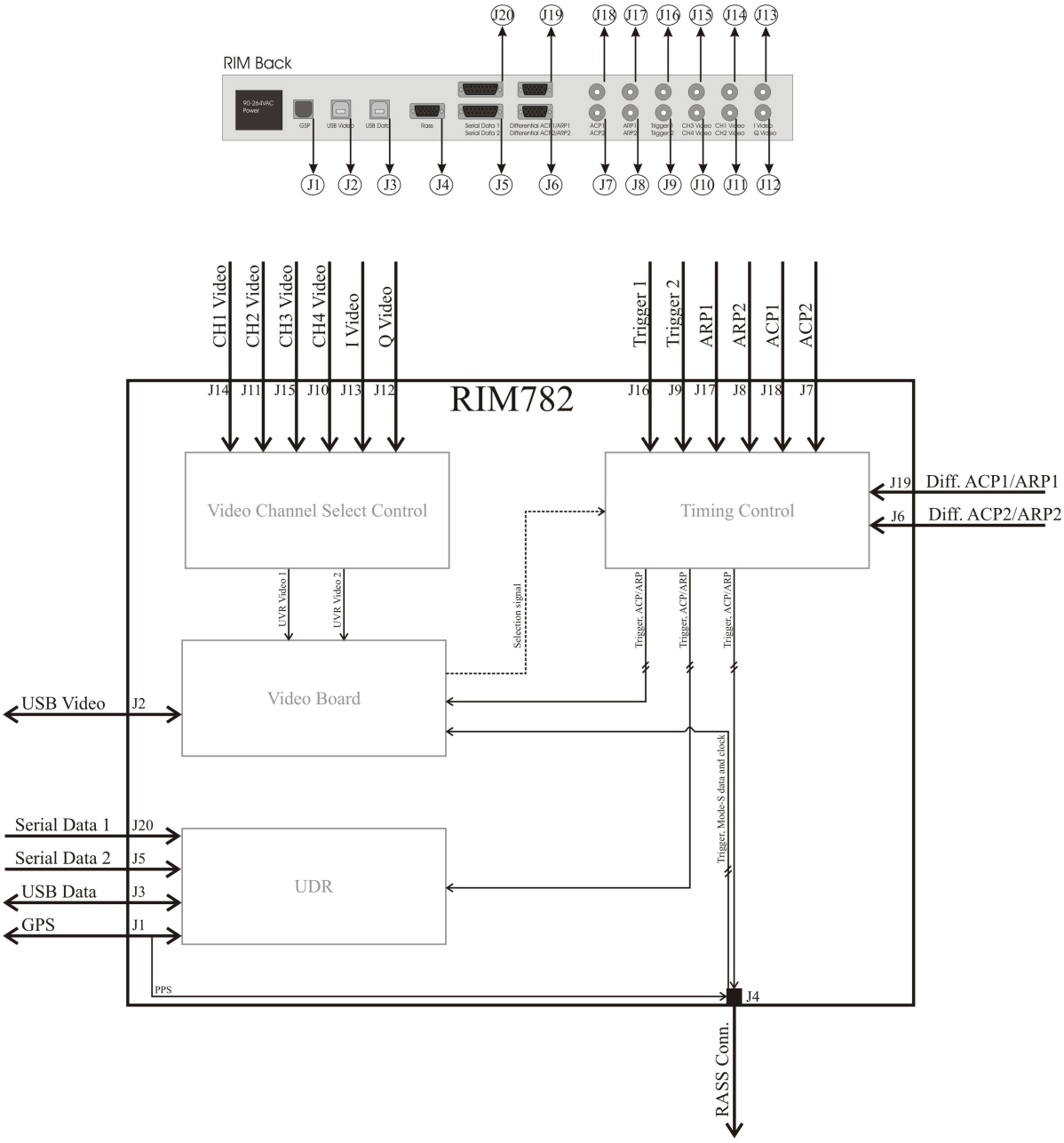



*Figure 1: Block Diagram RIM782*

### 1.2.2. Connectors

Based on the functioning, we can split up the RIM782 in 3 main parts:

- The video recorder functionality or Video Board
- The data recorder functionality or simply USB Data Recorder (UDR)
- The GPS connection

The different connectors are described in the next paragraphs, according to their functionality as explained above.

### 1.2.2.1. Video Board

The Video Board in the RIM782 has 6 analogue video signal inputs. These are suitable for PSR video signals, SSR video signals and weather radar video signals. The connectors are described in the following table:

*Table 1: Video Board Connectors*

| Name | Specification | Connector Type | Value |
|---|---|---|---|
| Ch1/2/3/4 Video | Video input | 4x BNC | -2V, +2V, 10kΩ |
| I/Q Video | I/Q input | 2x BNC | -2V, +2V, 10kΩ |
| ACP1/2 , ARP1/2 | Single ended ACP or ARP input | 2x BNC | TTL |
| Differential ACP1/2 , ARP1/2 | Differential ACP/ARP input | 2x DB-9 female | TTL |
| Trigger 1/2 | Trigger input | 2x BNC | TTL |
| RASS | Input: Mode-S Clock, Mode-S Data, trigger<br>Output: ACP, ARP, event, trigger | DB15HD female | TTL |
| USB Video | USB Video | USB | USB2.0 |

The separate USB video connector is intended for dedicated video stream bandwidth. The above listed connectors correspond to the following parts of the rear panel :

*Figure 2: Rear panel RIM782 – Video Board connectors*

The pin layout of the differential ACP/ARP DB9 connectors is shown in the table below:

*Table 2: Differential ACP/ARP DB9 connectors pin layout*

| Name | DB9(f) on RIM782 |
|---|---|
| NC (not connected) | 1 |
| ACP + | 2 |
| NC | 3 |
| ACP - | 4 |
| NC | 5 |
| ARP + | 6 |
| NC | 7 |
| ARP - | 8 |
| NC | 9 |

The pin layout of the RASS DB15HD connector is shown in the table below:

*Table 3: RASS DB15HD connector pin layout*

| **Name** | **DB15HD(f) on RIM782** |
|---|---|
| RASS ARP (output)<br>*(red connector on Intersoft DB15HD male cable to 5xBNC)* | 1 |
| RASS ACP (output)<br>*(green connector on Intersoft DB15HD male cable to 5xBNC)* | 2 |
| RASS PPS (output)<br>*(blue connector on Intersoft DB15HD male cable to 5xBNC)* | 3 |
| *Reserved for future use* | 4 |
| *Reserved for future use* | 5 |
| GND | 6 |
| GND | 7 |
| GND | 8 |
| -12V | 9 |
| GND | 10 |
| *Reserved for future use* | 11 |
| RASS Mode-S data (input) | 12 |
| RASS Trigger (output)<br>*(grey connector on Intersoft DB15HD male cable to 5xBNC)* | 13 |
| RASS Trigger (input)<br>*(black connector on Intersoft DB15HD male cable to 5xBNC)* | 14 |
| RASS Mode-S Clock (input) | 15 |

#### 1.2.2.2. USB Data Recorder (UDR)

The RIM782 has 2 serial communication channels for active and passive recording. They can handle transmission speeds up to 128 Kb/s. Two electrical standards are supported: RS232 (single ended) and RS422 (differential). The serial data is fed to the recorder using a female DB15 connectors (alike X.21 connections) on the rear panel of the RIM782. The unit is supplied with 2 RS232 Probe modules for connection of the DB15 to DB25 standard RS232 connection. A whole range of synchronous protocols is supported and others can be programmed upon request.

The following passive protocols (up to 128k) can be handled by the RIM782:

- HDLC: Passive recording of HDLC bases protocols, including Lap-B and X25.3 Passive monitoring. (E.g. ASTERIX, RDIF)
- LINK 1: Passive recording of Military LINK 1 protocol
- SYNC 13: Passive recording of most bit protocols as implemented on US radars (CD1, CD2, ASR9, etc...)
- Aircat 500: passive recording of Thales specific protocol
- TVT2 military protocol
- EV760 protocol
- Output U-HDLC and bit protocols
- Bit Recording Protocols (9600 BAUD):

- AIRCAT 500
- ALENIA
- AUSTRO
- BMIL
- ERICSSON
- EUROCONTROL
- FPS 117
- HUGHES
- SVE
- TOSHIBA
- CUSTOMER SPECIFIC

As mentioned above, the UDR in the RIM782 has 2 serial synchronous ports. They can be used either as input or output. The connectors are described in the following table:

*Table 4: UDR Connectors*

| Name | Specification | Connector Type | Value |
|---|---|---|---|
| Serial Data 1/2 | Serial Data 1/2 | 2x DB15 female | Synchronous serial input RS232/RS422 |
| USB Data | USB data | USB | USB2.0 |

The above listed connectors correspond to the following parts of the rear panel :

*Figure 3: Rear panel RIM782 – UDR connectors*

Radar data passed over LAN (TCP, UDP) will be fed directly into the PC via the Ethernet adapter, without the need of the RIM782.

The pin layout of the Serial Data 1/2 DB15 connectors is shown in the table below:

*Table 5: Serial Data 1/2 DB15 connectors pin layout*

| **Name** | **DB9(f) on RIM782** |
|---|---|
| Gnd | 1,8 |
| TxD+ | 9 |
| TxD- | 2 |
| RxD+ | 11 |
| RxD- | 4 |
| RxC+ | 13 |
| RxC- | 6 |
| TrxC+ | 14 |
| TrxC- | 7 |
| TxC+ | / |
| TxC- | / |
| -10Volt | 12 |
| +10Volt | 5 |
| +5Volt (USB4.2V) | 15 |

The specifications of the serial inputs/outputs are listed in the following tables:

*Table 6: RS 232 C Receivers (compatible with RS232C standard)*

| | |
|---|---|
| Input resistance | 3kΩ min. , 5kΩ typ. , 7kΩ max. |
| Low threshold | 1.2V typ. , 0.8 min. |
| High threshold | 1.7V typ. , 3.0 max. |
| Impedance | 5kΩ typ. (+15V to -15V) |

*Table 7: RS 232 C Drivers (compatible with RS232C standard)*

| | |
|---|---|
| High Level Output | +5V min. , +15V max. |
| Low Level Output | -15V min. , -5V max. |
| Short Circuit Current | ± 100mA |
| Power off Impedance | 300Ω |
| Slew Rate RL=3K, CL=50pF | 30V/µs |

*Table 8: RS422 Receivers (compatible with RS422 standard)*

| | |
|---|---|
| Input resistance common mode | 15kΩ typ. (-7 to +12V) |
| Receiver sensitivity | ± 0.2V typ. |
| Common mode range | -7.0V min. , +7.0V max. |

*Table 9: RS422 Drivers (compatible with RS422 standard)*

| | |
|---|---|
| Short Circuit Current | 150mA |
| Transition Time | 40ns max. (10-90%) |
| Output Current | 28mA min. (RL=54Ω) |

### 1.2.2.3. Global Positioning System (GPS450)

Intersoft Electronics' GPS450 can be connected to the RIM782 so that the recordings made will be UTC time stamped. There is one GPS450 connector on the rear panel foreseen:

*Table 10: GPS Connectors*

| Name | Specification | Connector Type | Value |
|---|---|---|---|
| GPS450 | GPS | RJ45 | Intersoft proprietary |

The GPS data is distributed to the UVR and UDR sections of the RIM782.

# 2. Downlink Measurement

## 2.1. Theory

The Downlink measurement enables the user to measure the HPD antenna pattern at reception. It uses the Radar Interface Module to sample the video level signals of the input channels. The measurement uses a sampling window which is selected by the user. In this sampling window, the software determines the mean amplitude of the CW signal (or synchronous pulses) received from the uplink (field) setup. The sampling window can be shown at all times, continuously updated with the sampled data.

The measured amplitudes are then converted to the received RF power at coupler level, using the receiver calibration file. The receiver calibration file is a table describing the radar receiver output voltage vs. the RF input power, and needs to be measured before the downlink measurement can be performed.

## 2.2. Software

### 2.2.1. Getting Started

***Note: First of all make sure the receiver calibration file is available in the active campaign folder. After the receiver calibration was performed with the RFA641, the file should be copied to the computer used for the downlink measurement. It must be present in the (M)SSR\CALIB subdirectory of the selected campaign folder.***

Once it is sure the calibration file is present, the RFA641 can be packed for the field setup to be prepared at the uplink site. The RFA641 field set-up is explained in the RFA641 User Manual. Make the RIM782 Downlink connections as shown in the connection diagram (Annex 7.2. ).

The ***RASS-M Downlink*** application can be loaded using the ***Downlink*** button on the RASS-S Toolbox.

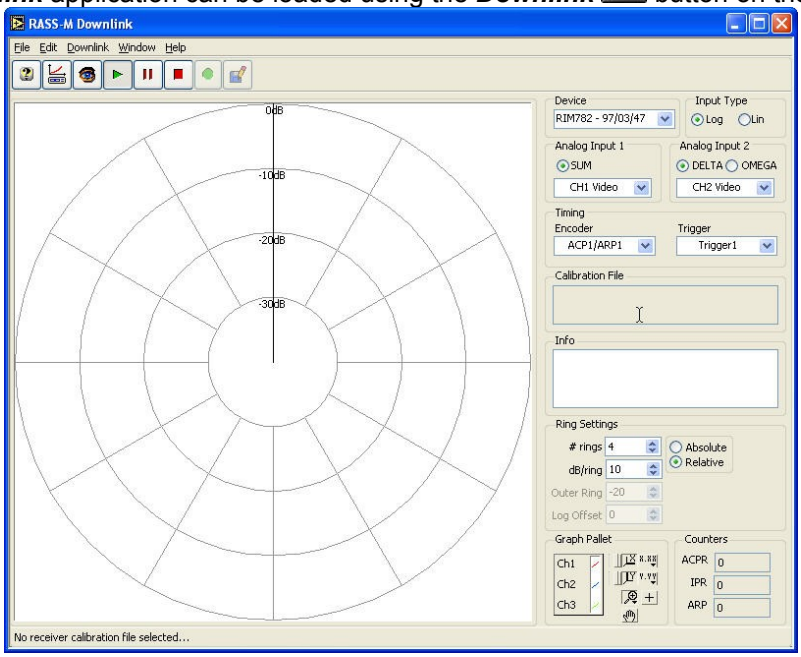



*Figure 4: Downlink software*

### 2.2.2. Making a Recording

1. The first step is to load the receiver calibration file (which can be created using the RFA641, this calibration is described in the RFA641 User Manual). Click the ***Load Rx Calibration Table*** button to be able to select the correct calibration file.

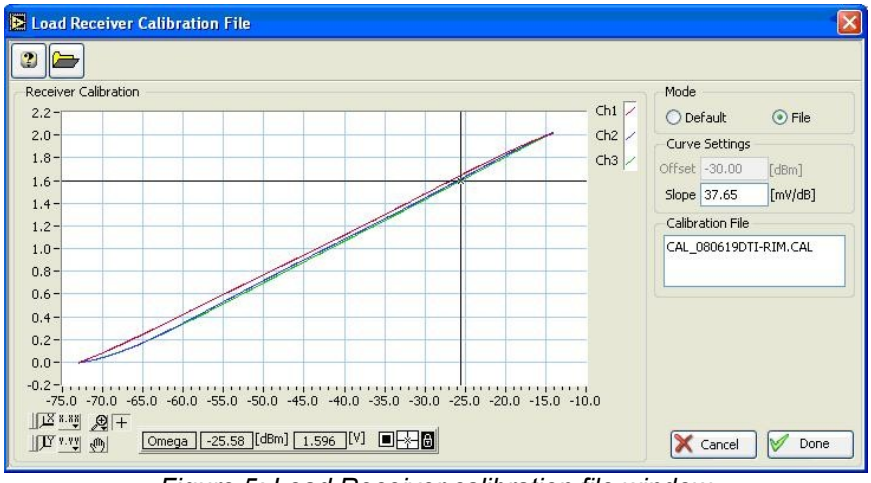



*Figure 5: Load Receiver calibration file window*

The calibration file is used to convert the measured voltages to the received RF power at coupler level. When the user chooses not to select a Rx Calibration File, the default curve will be used. Select Done to return to the main Downlink window or cancel to return without making changes.

2. Click the ***Scope Preview*** button to open the Scope window allowing you to select the measurement window.

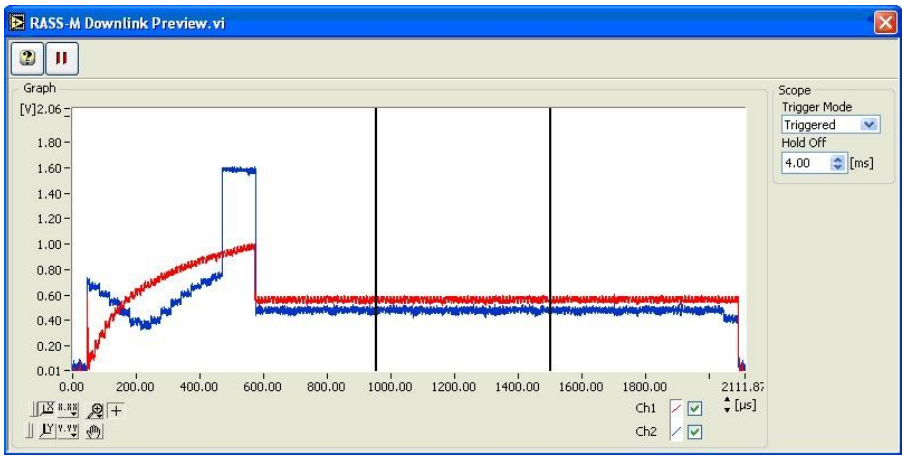



*Figure 6: Scope Window*

3. Select the preferred trigger method.

4. Set the cursors of the measurement window outside the STC period and within the range (as shown in figure 6). The HPD signals in the polar diagram of the main downlink window are updated automatically each time a cursor is moved. The mean value between the cursors will be calculated and used for the measurement.

5. Set the parameters on the front panel according to the radar type and connections.

6. Before logging the measurement data, you can enter some comments in the ***Info field***. These

comments are stored with each scan, so in case you make changes between successive ARPs, the new info entered is stored together with the recorded HPDs. E.g. if the recording is intended for a 3D measurement, the beam elevation can be entered.

7. Depending on the Absolute/Relative switch, the graph is shown in an absolute dBm scale or a relative dB scale.
8. Verify normal operation of the measurement:
   - ACPR should correspond to the number of ACPS according to the resolution of the encoder.
   - IPR indicates the number of interrogations per revolution.
9. Now ***set-up the RFA641 as CW source*** (both set-up and software are described in the RFA641 user manual but will be described briefly in this paragraph as well). The set-up of the RFA641 is also shown in the Downlink set-up (annex 7.2. ). When the RFA641 is set-up, open the ***Uplink*** software program and switch the running tool to ***Transmit*** mode. The ***HPD Preferences*** window will open automatically, change the ***Tx type*** to ***CW*** and click ***OK***. As soon as the CW signal is available, the downlink antenna diagram will be visible in the polar diagram on the front panel.
10. The HPD signals are shown in the polar diagram. The antenna diagram window should be at the noise level of the receiver as long as no signal is sent from the uplink side. The two (or single) channel(s) to be recorded can be selected with the parameters on the Downlink front: Σ, Δ, Ω, are respectively shown in red, blue and green.

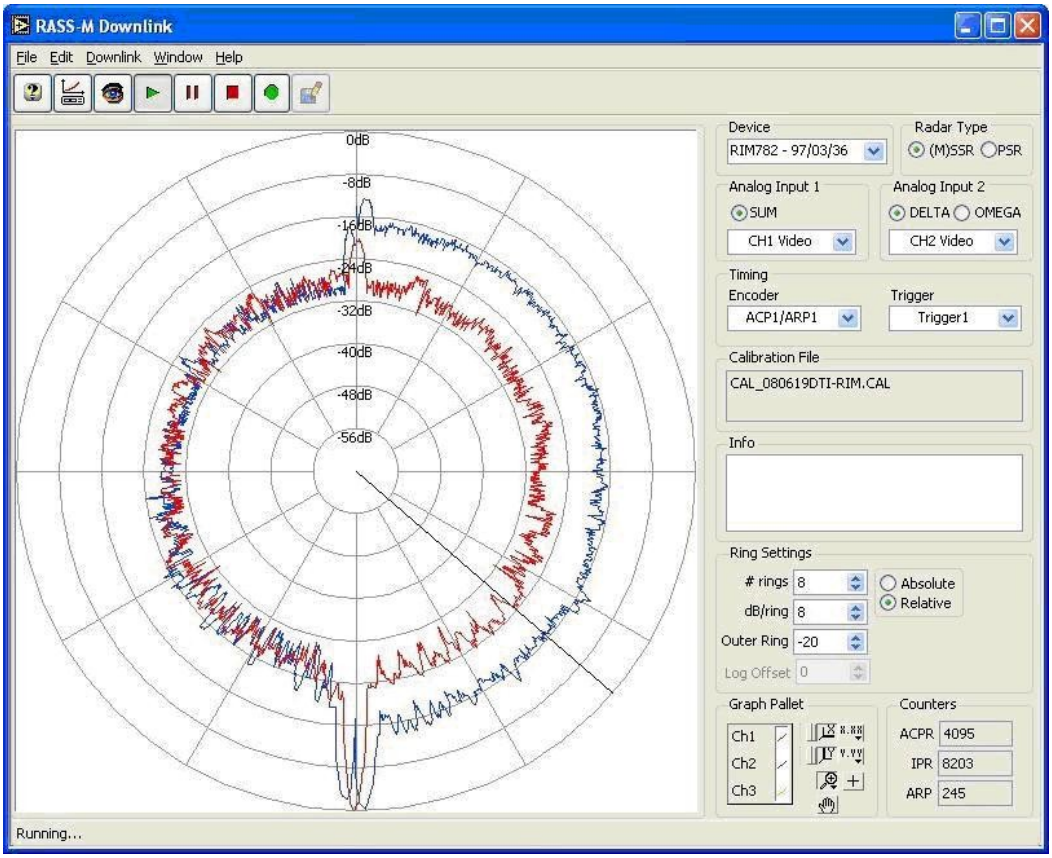



*Figure 7: Downlink example of Didactical Test Interrogator*

11. Start recording using the ***Record*** button.

12. When the recording is stopped (***Stop*** button) a dialog box will pop up to select a logging file. The software will suggest a default file name (Downlink-yyyymmdd-time). One can also save the data to file using the ***Save*** button.

### 2.2.3. Analysis

### 2.2.4. View HPD Logfiles

To view the measured antenna diagrams, RASS-S contains a universal tool, called View HPD Logging. The program is capable of reading, recognizing and displaying Uplink and Downlink HPD logfiles of both (M)SSR and PSR measurements.

1. Open the ***View HPD Logfiles*** program from the ***Downlink*** button on the RASS-S toolbox.

2. Use the ***Load*** button to select a downlink logfile, select the file of interest and click the ***OK*** button. The selected file will be displayed in the active layer and its file name will be presented in the ***Layer info*** sub-window, the date and time of the recording is shown and diagram parameters of the selected logging are displayed.

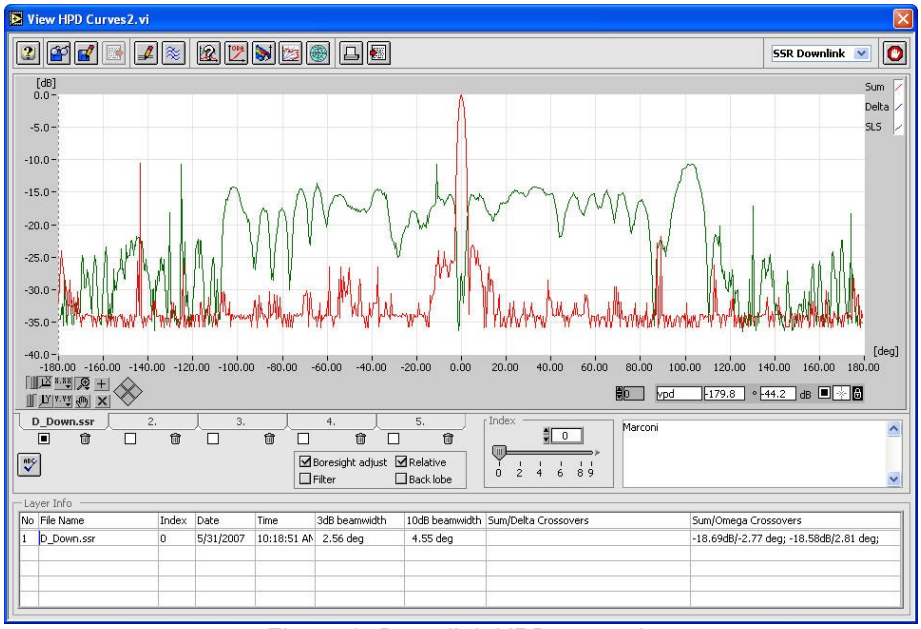



*Figure 8: Downlink HPD example*

3. It is possible to overlay antenna diagrams for comparison in up to five layers: Select a layer by clicking on a layer tab. The View HPD Logfiles program allows to overlay up to 5 layers. Each of the layers can be temporarily hidden. This is done by means of the check box selectors to select the displaying of the curves. The ***Empty*** button allows clearing the active layer. It is even possible to superimpose SSR Uplink, SSR Downlink, PSR Uplink or PSR Downlink curves on top of each other. Any combination is possible.

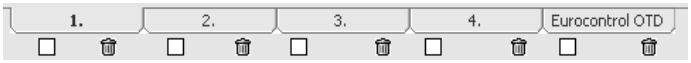



*Figure 9: Layer tabs and selectors*

4. Click the ***OTD*** button to calculate the OTD parameters. The OTD window will appear. Click the ***Return*** button after inspection. In case you have antenna diagram data available in a TAB-separated file, the ***Import*** function can be used to load this file type into the selected layer. The software expects a diagram defined in four columns: Azimuth [deg], Sum [dB], Delta [dB], SLS [dB]. The data points must be defined equidistant in azimuth.

HPD Data SSR 159 degrees

| Azimuth[deg] | Sum[dB] | Delta[dB] | SLS[dB] |
|---|---|---|---|
| -90.100 | -43.278 | 13.901 | -40.905 |
| -90.000 | -43.278 | 13.901 | -40.988 |
| -89.900 | -43.278 | 13.901 | -41.080 |
| -89.800 | -43.278 | 13.901 | -41.184 |
| -89.700 | -43.278 | 13.901 | -41.304 |

*Figure 10: Antenna diagram data in TAB-separated file*

5. An existing logfile might consist of multiple measurements, from which you may want to select the best ones to be kept in a separate logfile. This operation can easily be performed using the ***Save*** button. Select the diagram you want to transfer to a new or existing logfile using the standard procedure. (Start program and select a curve with the Index control.) Use the Save button to evoke the Log panel. If no logfile has been selected yet: Open an existing logfile with the ***Open logfile*** button or create a new logfile with the ***New Logfile*** button. In both cases a file dialog will appear. The name of the newly selected logfile will be indicated in the ***Current Logfile*** string indicator. Use the ***Add logging*** button to add the current data.
If a logfile has already been selected: In this case the logfile string indicates the selected file name. Use the ***Add Logging*** button to append the current data to the logfile. Use the ***Cancel*** button to cancel the operation.

6. If you recorded multiple HPD diagrams from different elevations, you can stack these on top of each other and create VPD diagrams or 3D diagrams using the following buttons: ***3D*** and ***VPD***. It is also possible to view the data in a polar view mode by clicking the ***Polar View*** button to display the layers in polar mode.

7. The HPD data can be exported using the ***Export*** button. This will evoke a save file dialog, pointing to the “Exports” subdirectory of the active campaign folder. The resulting file consists of a text file containing a table. This table is TAB separated and can be imported by any Spreadsheet program. The file consists of four columns: Azimuth [deg]; Sum Amplitude [dB]; Delta Amplitude [dB]; SLS Amplitude [dB]. The numerical data is converted in a string format with a 3-digit precision.

## 2.2.5. User Defined OTD Limits

The OTD Limits section displays the OTD Limits applied to the calculated antenna parameters, the OTD section can be called using the ***OTD*** button. Whenever the program is called, it will first read the limits from an OTD Definition file. The OTD error messages will be displayed accordingly.

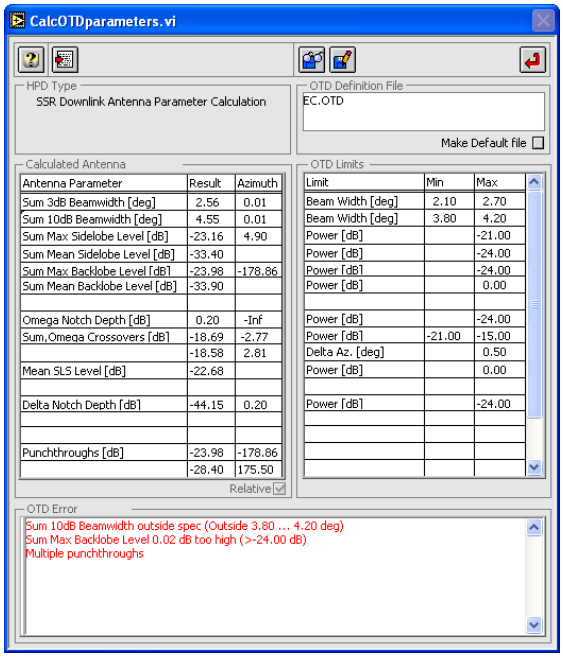

CalcOTDparameters.vi
HPD Type
SSR Downlink Antenna Parameter Calculation
OTD Definition File
EC.OTD
Make Default file
Calculated Antenna
Antenna Parameter | Result | Azimuth
Sum 3dB Beamwidth [deg] | 2.56 | 0.01
Sum 10dB Beamwidth [deg] | 4.55 | 0.01
Sum Max Sidelobe Level [dB] | -23.16 | 4.90
Sum Mean Sidelobe Level [dB] | -33.40 |
Sum Max Backlobe Level [dB] | -23.98 | -178.86
Sum Mean Backlobe Level [dB] | -33.90 |
Omega Notch Depth [dB] | 0.20 | -Inf
Sum,Omega Crossovers [dB] | -18.69 | -2.77
-18.58 | 2.81
Mean SLS Level [dB] | -22.68 |
Delta Notch Depth [dB] | -44.15 | 0.20
Punchthroughs [dB] | -23.98 | -178.86
-28.40 | 175.50
Relative
OTD Limits
Limit | Min | Max
Beam Width [deg] | 2.10 | 2.70
Beam Width [deg] | 3.80 | 4.20
Power [dB] | -21.00
Power [dB] | -24.00
Power [dB] | -24.00
Power [dB] | 0.00
Power [dB] | -24.00
Power [dB] | -21.00 | -15.00
Delta Az. [deg] | 0.50
Power [dB] | 0.00
Power [dB] | -24.00
OTD Error
Sum 10dB Beamwidth outside spec (Outside 3.80 ... 4.20 deg)
Sum Max Backlobe Level 0.02 dB too high (>-24.00 dB)
Multiple punchthroughs

*Figure 11: Calculate OTD Parameters window*

OTD Definition files are present in the GENERAL\OTD subdirectory of the CAMPAIGN directory. Currently the file 'EC.OTD' is the only file available. This file contains the EC defined parameter limits according to the description in Annex 1: Critical Parameters of SSR Antennas.

The loaded OTD definition file is indicated on the program front panel.

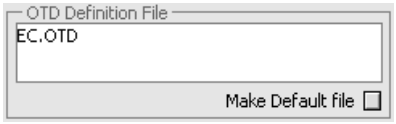



*Figure 12: OTD Definition File*

The user can change any of these parameters and save the set of limits to a new file in order to create a new OTD definition file. This can be done by clicking the ***Save*** button. In case you want to change the OTD definition file, click the ***Load*** button.

In some cases you might want to set your OTD definition as default calculation. Check the ***Make Default file*** checkbox upon closing the OTD program, the active OTD definition file will be set as the default file to be loaded whenever the OTD program is called.

*Figure 13: Make Default File checkbox*

The following list describes the OTD limits that can be set by the user. Please note that all limits are defined as relative to the SUM/PSR max power level.

1. SUM/PSR 3dB Beamwidth Min, Max [deg]: Allowed min. and max. for the 3dB beam width
2. SUM/PSR 10dB Beamwidth Min, Max[deg]: Allowed min. and max. for the 10dB beam width
3. Sum/PSR Max sidelobe level [dB(m)]: Allowed max. for the Sum/PSR max. Sidelobe level.
4. Sum/PSR Max Backlobe level [dB(m)]: Allowed max. for the Sum/PSR Backlobe level.
5. Omega Notch Depth [dB(m)]: Allowed max. for the Omega Notch Depth.
6. Sum, Omega Crossovers: Power [dB] min, max: Allowed range for the crossover level.
7. Delta Az [deg] Max: Allowed max. azimuth difference for the crossovers to be recognized as symmetrical.
8. Delta Notch Depth [dB(m)]: Allowed max. for the Delta Notch Depth.
9. Sum, Delta Crossovers
10. Power [dB] Min, Max: Allowed range for the crossover level
11. Azimuth [deg]: Allowed max. azimuth for the crossover position.
12. Delta Az. [deg] Max: Allowed max. azimuth difference for the crossovers to be recognized as symmetrical.

For each of the limits defined the corresponding parameter is checked. In case the calculated antenna parameter is outside the set limits an error message is created in the ***OTD Error Messages*** window. This contains the statements that the parameters are outside specification and displays the parameters result and the set limits. In case of punch-throughs, a list of the punch-throughs is created indicating level and azimuth of each punch-through.

Using the ***Export*** button you can export the OTD parameters, limits and error messages to a tab-separated file.

# 3. Sectorial Video Recording

## 3.1. Theory

The Sectorial Video Recorder is based on the RIM782 hardware and introduces a new revolution in radar video recording. Previous recording tools had either the disadvantage of being limited in range/azimuth (RASS-S windowed recording) or were difficult to setup and limited to MSSR video pulses (RASS-S pulse recording). The sectorial video recorder will combine the advantages of the RASS-S window based recording as well as pulse recording into one single tool. Because of the high data throughput required for this recording, we can no longer support the RVRxxx plus RVI299 hardware for the sectorial video recording. The sectorial video recorder has been designed to create highly detailed video recordings, unlimited in both range as azimuth.

## 3.2. Software

### 3.2.1. Getting Started

The Sectorial Video Recorder tool can be opened from the ***Video*** button on the RASS-S toolbox.

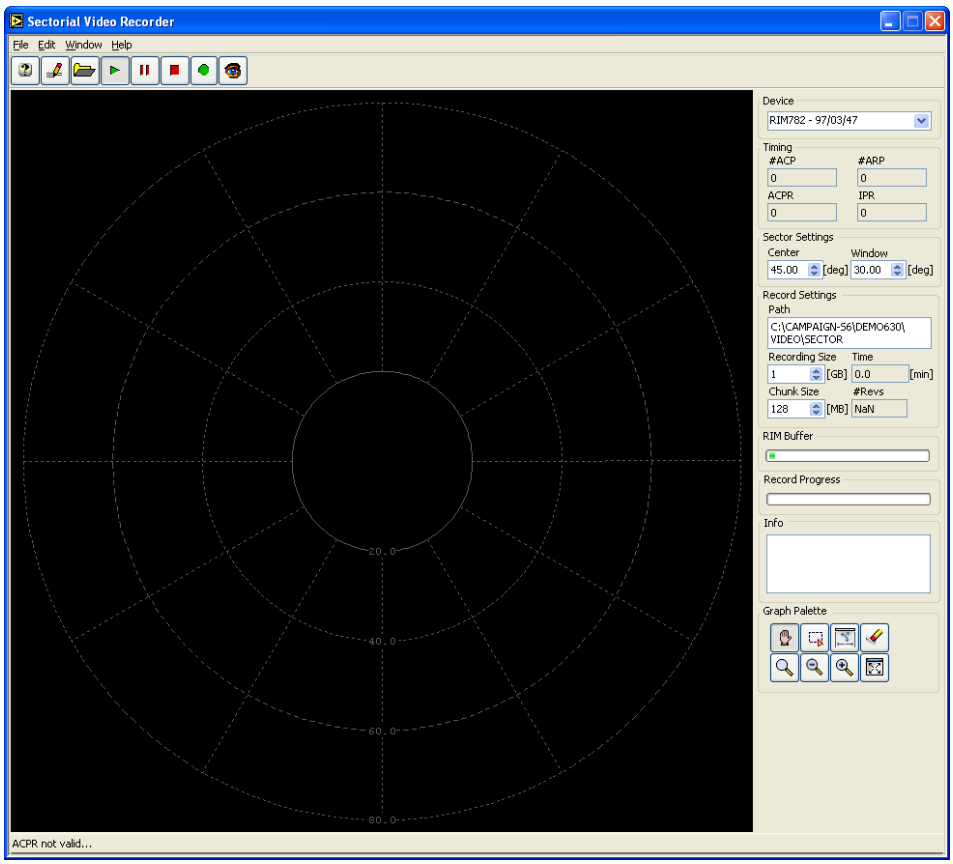



*Figure 14: Sectorial Video Recorder software*

Create the set-up shown in Annex 3: Sectorial Video Recording Connection Diagram.

### 3.2.2. Making a Recording

1. When the ***Select folder*** button is clicked the user will be prompted to select a folder which will contain the sectorial recording. By default the folder Campaign\VIDEO\SECTOR will be selected. The user is encouraged to create a new folder for each recording.

***Caution: If an existing folder is selected the previous recording will be overwritten. A warning will be issued to make sure this does not happen accidentally.***

2. With the Sector Settings the user can select a part of a scan to reduce the amount of disk space needed for the recording. The ***window width*** can be set between 0deg and 360deg and largely depends on the throughput capability to the PC hard disk and processing power of the computer used. A 360 degree window will result in a continuous 32MB/sec data stream to disk.

*Figure 15: Sector settings*

3. Using the Record Settings the user can control the amount and size of the files used during a recording. The ***Recording Size*** control controls the amount of disk space that will be allocated for this recording. The recording will be chopped into smaller pieces; the size of the pieces can be set with the ***Chunk Size*** control.

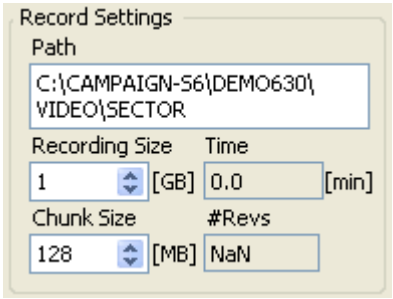



*Figure 16: Recording settings*

4. The recording is started by clicking the ***Record*** button. Clicking it again or clicking the ***Stop*** button will halt the recording. If the allocated space is full the recording will stop automatically.

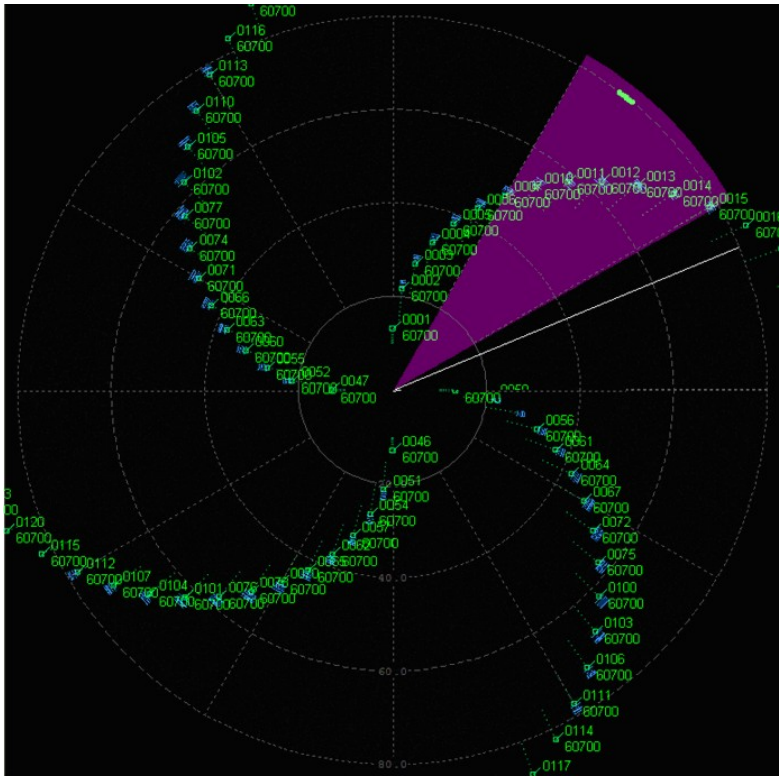


*Figure 17: Example sectorial recording of scenario*

## 3.2.3. Advanced Settings

### 3.2.3.1. Graph Palette: Zoom/Select function

The graph palette can be found in the right bottom corner of the main window and is used to zoom in or select a part of the data. The following buttons are available:

*Table 11: Zoom/select functions sector recording*

| Button | Usage |
|---|---|
| Pan | Switch the display to pan mode, use the cursor to move the display area around |
| Select | Switch the display to select mode, use the cursor to select targets |
| RBL | Enables the Range Bearing Line on the display |
| Erase all | Clear all display data |
| Zoom | Switch the display to Zoom mode, use the cursor to zoom into areas of interest |
| Zoom out | Zoom out progressively until maximum viewing area is visible |
| Zoom in | Zoom in progressively until maximum zoom (highest level of detail) is reached |
| Home | Switch back to default zoom (-500) and center (or press the home button) |

### 3.2.3.2. General Settings

The ***General Settings*** window can be opened by pressing the ***Settings*** button and selecting the general tab using the ***General*** button on the left.

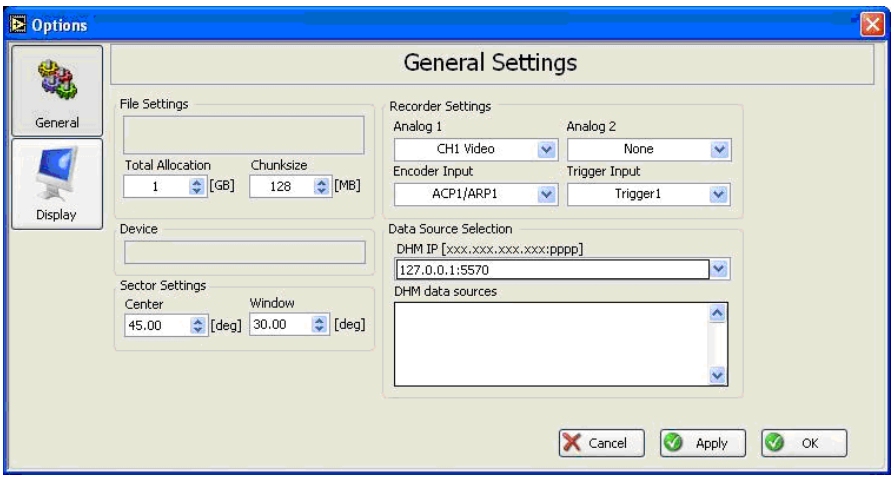



*Figure 18: General Settings window*

The left part of the General Settings tab contains the most frequently used settings and therefore has been repeated on the sectorial video recorder main window.

***Note: In order for changes to take effect, the Apply or OK button in the settings window needs to be pressed.***

If the ***Apply*** button is pressed the changes will be saved and the General Settings window remains open. In this case one can return to the main window using the ***OK*** button or by closing the window. If the ***OK*** button is pressed the changes will be applied and the General Settings window will close. In case no changes need to be made, one can close the General Settings window by pressing the ***Cancel*** button or closing the window.

In the right part of the General Settings you can control the recorder settings and the data source selection:

1. Recorder Settings: The Recorder Settings control which video input(s), encoder (ACP/ARP) input and trigger input are sampled and recorded. The video input selected for Analog 1 will be displayed. If only one video input is selected for recording, it will be sampled at 16MSPS. If two video inputs are selected, they will be recorded at 8MSPS.
2. Data Source Selection: This optional setting allows the user to connect to any DHM session running on the local network. The DHM session should be configured to have a digital D6 output. Refer to the RASS-R user manual on the Data Handler Module (DHM) for more details on this.

### 3.2.3.3. Display Settings

The ***Display Settings*** window can be opened by pressing the ***Settings*** button and selecting the Display tab using the ***Display*** button on the left.

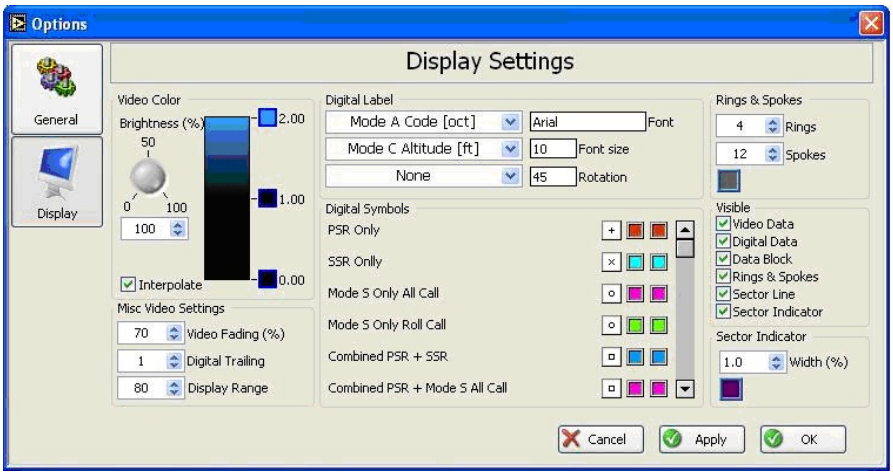



*Figure 19: Display Settings window*

The settings on the left control the video layer display. The following video settings can be set:

- Video color: The video color graph allows you to set different colors for different voltages being sampled and displayed. Sliding the values up and down will change them, clicking the color boxes allows the user to change the color. A new level can be dragged out of the color ramp as well.
- Brightness: The brightness knob will determine the intensity of which the different levels are displayed.
- Interpolate: The interpolate check box allows the user to switch between discrete voltage levels or a more gradual color ramp.
- Video fading: The video fading control allows you to have a fading effect on the video being displayed.
- Digital trailing: The digital trailing control allows you to set a number of scans that the digital data will remain on the display.
- Display range: The display range control limits the amount of data drawn on the PPI display.

***Note: The Display Range control will not limit the data range in the recordings. All sector recordings will cover full range!***

The center part settings control the optional digital part of the display. In order to have digital data present on the display the user needs to connect to a DHM session having a D6 digital output running. This can either be on the local computer or any other computer on the network.

- Digital label: The digital label settings allow the user to control which digital information is displayed. Optionally font, font size and rotation can be changed.
- Digital symbols: Digital symbols control how a specific target is displayed. Both symbol and color can be changed.

The right part of the Display Settings controls some more general display settings.

- Rings & Spokes: control the amount of rings and spokes drawn on the display, and the color of the rings and spokes.
- Visible: The visible check boxes control which data is drawn on the display. This way some parts of data can be temporarily disabled.

- Sector Indicator: This control allows setting the width of the sector indicator.

## 3.3. Analysis: Sectorial SSR Video Viewer

### 3.3.1. Introduction

This user manual describes the functionality of the Sectorial Viewer program. The sectorial video viewer provides a detailed view of the video inputs and timing signals recorded with the Sectorial Video Recorder.

The benefit of the Sectorial Video Recording is that (with the exception of the sector selection in azimuth) it does a continuous recording of all selected input data.

Where the Sectorial Video Recorder displays the data in a PPI window for basic viewing during the recording, the Sectorial Viewer is more analysis oriented and therefore provides an XY view of the video data. The following data is shown:

- Video Display: consists of a Range-Azimuth view of the selected video signal, which is displayed in an intensity graph. The range reference is selectable from different interrogation types as found in the recording.
- Timing: The interrogation signal (trigger) is analyzed during an indexing stage and processed in order to detect the known interrogation modes according to Annex 10 timing. The different modes are categorized and provide a range reference selection for the video display. The Interrogation View window displays the timing of the detected interrogations. Obviously the ARP/ACP timing is used to calculate azimuths.
- X View/Y View: An X View and a Y view window are available to view the video signal as it is sampled, sliced at the position of the Video Display cursor either in X or Y direction.
- Reply Info: The video data is decoded into A/C/S replies. The detected replies are then linked to the corresponding interrogation. This information is displayed in the Reply window in textual format.

### 3.3.2. Getting Started

The Sectorial Video Viewer tool can be opened from the ***Video***

button on the RASS-S toolbox (the tool is called ***View Sector Recording*** in the list).

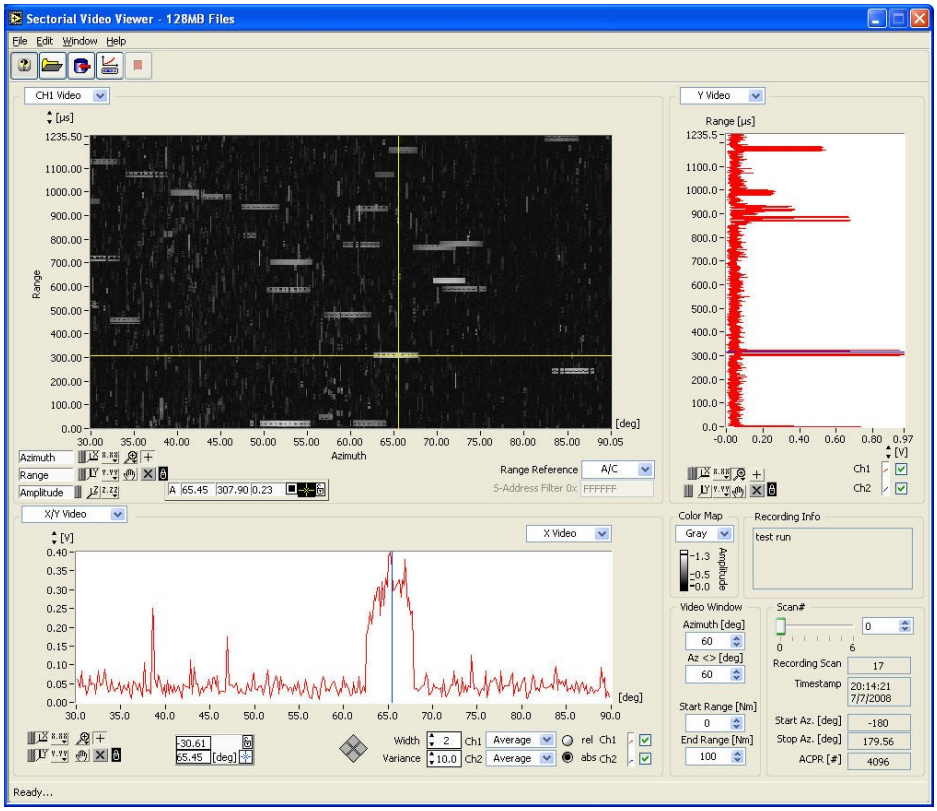



*Figure 20: Sectorial Video Viewer - example*

### 3.3.3. Sectorial Video Viewer

1. Click the ***Select Folder*** button to select a folder which contains the sectorial recording.

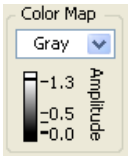
2. Click the ***Automatic Indexing*** button to start the indexing process. This process decodes all recorded interrogations and creates an interrogation index file. Since it has to page through the complete recording it can take up to 10% of the recording time. If no indexing was performed before this process will start automatically. The user can abort the indexing using the ***Stop*** button, but only the revolutions that were processed can be viewed then.
   The indexer runs detached. As soon as the first scan is processed, the user can start analyzing the data. Once indexing is done the video display will show the data of the first scan, relative to the default range reference.

3. When the file is loaded, the ***Video Window*** controls determine the section of the data to be displayed. The video data which is shown in the graph is decimated to minimize memory requirements upon loading the file. Full resolution is achieved by zooming in or adjusting the window size.

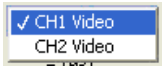
4. Next to the window size controls you can find the properties of the recording:
   - Recording info (user comments)
   - Scan # (default at 0)
   - Recording Scan #
   - Time of recording
   - Start and Stop Azimuth
   - ACPR

### 3.3.4. Advanced Settings

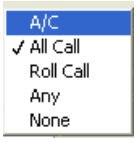
1. ***Color Map Control***: The Video Display shows the video data in a Range (Y) – Azimuth(X) intensity graph. The Z scale represents the signal voltage and the color mapping is selectable using the color map control. The horizontal scale is always Azimuth in degrees; the vertical scale is Range, selectable in µs or Nm.



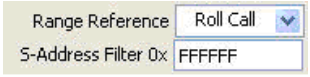

2. ***Channel Selector***: Upon loading the data file the viewer reads the properties of the recording. The channel selector will indicate the names of the channels selected in the recording. The example in this case has two channels; the Ch1 Video is currently being displayed.



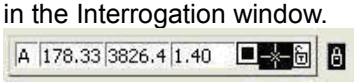

3. ***Range Reference Control***: The Range Reference control sets the reference timing for both the video window and the interrogation window.




The timing can be set relative to A/C interrogations, All Call interrogations, Roll Call interrogations or all of the above. In case the user selects ‘Roll Call’, the S-Address Filter needs to be filled. The software will only display the data with the corresponding S-Address. To view all data, one should fill in “FFFFFF” as S-Address.




4. ***Display Cursor***: The data available at the cursor is also shown into separate graphs as Voltage vs Azimuth (X View) or Voltage vs Time (Y View) (explained more thoroughly in the next section). The cursor displays shows the numerical Azimuth, Range and Voltage values at the cursor position. The lock next to the cursor display allows locking the X position of the cursor to the interrogation selected in the Interrogation window.

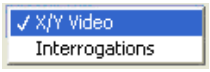


## 3.3.5. Different Viewing Modes/Processing/Analysis Methods

***General Note: Please note that the X scale can be locked to the X/Y scale of the Video Display.***

### 3.3.5.1. X Window – X Video View/Y Video View

The ***X/Y Video*** viewing mode is determined by the ***Slow Time Display Mode*** Selector:




In X/Y Video view the data can be viewed in two ways:

- X Video: A horizontal data slice is shown of the video signal available at the Y cursor position of the Video Display cursor. This is normally used to view SUM and DELTA modulation of the replies (or SUM/OBA).

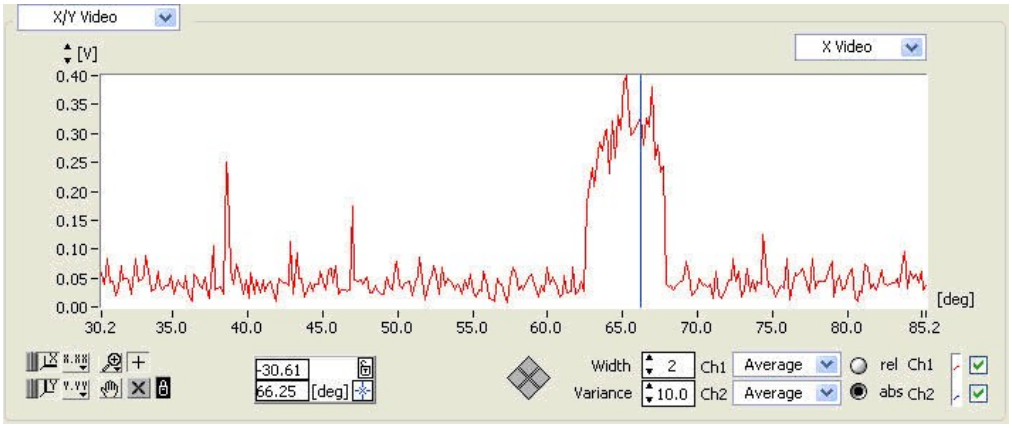



*Figure 21: X Video View*

- Y Video: A vertical data slice at the Video Display X cursor position is taken and displayed. This allows you to view the sampled data in oscilloscope view.

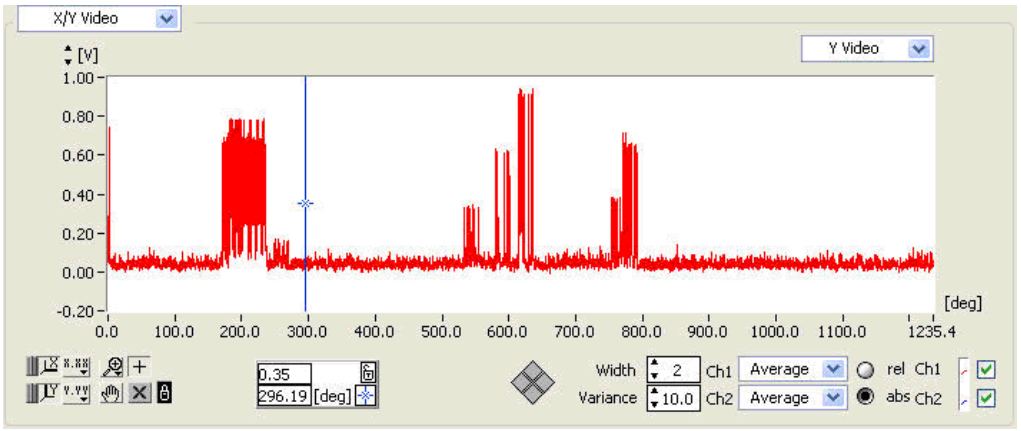



*Figure 22: Y Video View in X window*

When the Receiver Calibration Table is loaded, the data can be shown in absolute power (dBm).

### 3.3.5.2. X Window – Interrogation View

Set the ***Slow Time Display Mode*** selector in ***Interrogations*** mode to view the interrogations vs. azimuth:

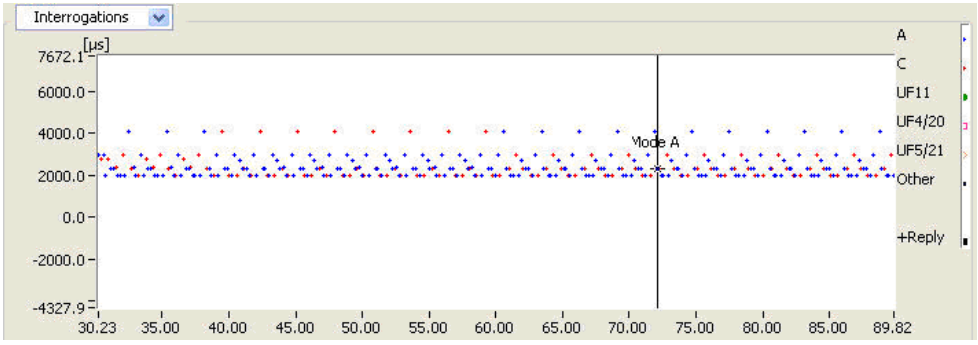
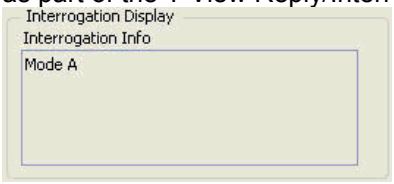



*Figure 23: Interrogation View*

In this viewing mode the interrogation trigger is classified according to the graph legend.

The cursor allows viewing the data of a specific interrogation. This textual data of the interrogation is visible as part of the Y View Reply/Interrogations window and as a label on the cursor (see figure above).




### 3.3.5.3. Y Window – Y Video View

The Y Window has two video modes. Select the ***Y Video*** option of the ***Fast Time Display Mode*** selector. This mode allows the user to view the video data at the X cursor position of the Video Display cursor.

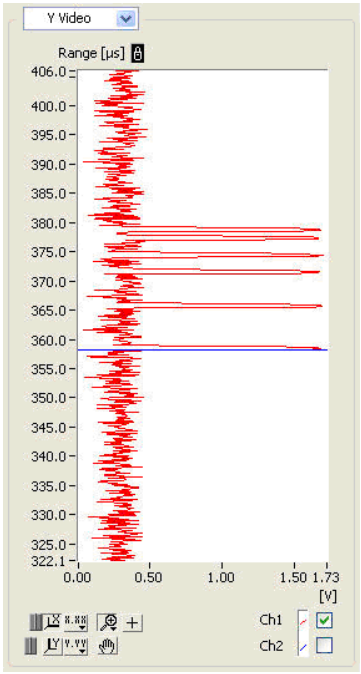



*Figure 24: Y Video Display*

### 3.3.5.4. Y Window- Reply View

The Y Video window also allows viewing the reply data extracted from the video pulses, when the ***Slow Time Display Mode*** selector is switched to the ***Replies*** option.

To decode the reply correctly one needs to:

- Zoom in on the reply which you want to decode; only the part which is inside the window (zoomed-in area) will be decoded. This means that in the case of a Mode S reply, the entire reply needs to be encapsulated in the window.
- Place the Y cursor before the reply which you want to be decoded (below the reply).
- Place the X position cursor: The software will decode the reply at the X-position, therefore by moving the X cursor you can decode the entire reply. Each time the X cursor is moved, you will see that the information in the Reply Display is updated.

The Reply Display gives 3 types of information for the reply selected with the cursor in the video window:

- Interrogation detail
- Reply detail
- Datalink detail (if applicable)

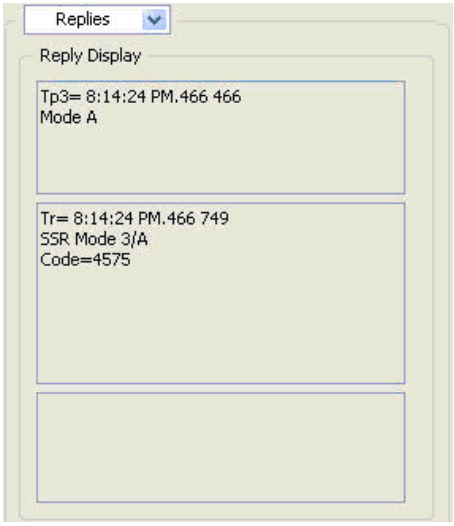



*Figure 25: Reply data extracted from video*

# 4. Sectorial Extractor

## 4.1. Theory

The Sectorial Extractor is used to convert a Sectorial Recording to the RASS-S Video Pulse format.

With the introduction of the RIM782 the concept of video recording has changed drastically. The Sectorial Recording provides continuous sampling of the connected video and timing channels in order to provide full range, full revolution recording of radar video and timing, and this without performing any thresholding or data reduction.

The previous generation of RASS-S video recorders were limited in capability due to the technologies available at that time. The only method of performing full range, full revolution recording of radar video and timing, was by performing pulse detection and only log the most important pulse characteristics. The resulting recording is a .pls video recording containing the detected pulses.

A lot of RASS-S Analysis tools are based on the pulse recording. In order to be able to use these well known tools on the Sectorial Recording, a convert function was needed to convert the Sectorial Recording into a Video Pulse Recording file.

The Sectorial Extractor provides a (user-selectable) threshold and performs the video pulse detection in software. It saves the resulting pulses to a .pls video pulse file.

## 4.2. Software

### 4.2.1. Getting Started

The Sectorial Extractor provides the basic selection for the source folder containing the Sectorial Recording, the destination folder that will contain the .pls video pulse file, and optionally it is possible to select a Rx Calibration file to allow selection of the threshold level at a specific Rx input level in dBm.

The Preview window provides a scope view of the recorded video channels, and is used to set the threshold level. It is possible to page through scans/interrogations and view the sampled video signals.

Once all selections are made the conversion can be started. The progress indicator gives detailed info on the conversion progress and the size of the resulting pulse file.

The Sectorial Extractor tool can be opened from the ***Video*** button on the RASS-S toolbox.

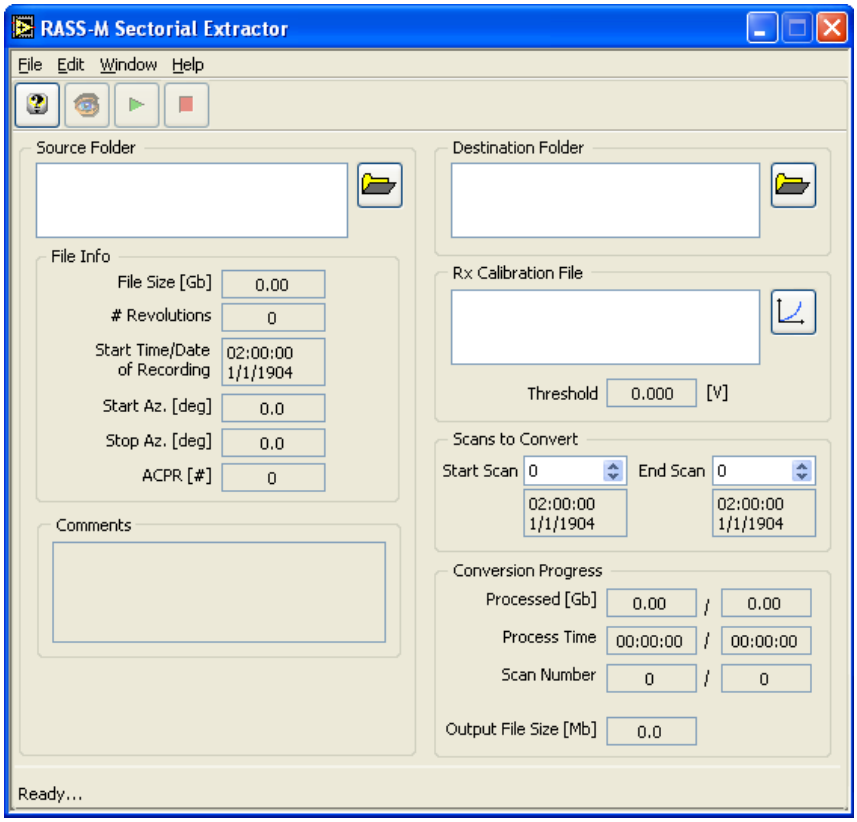



*Figure 26: Sectorial Extractor software*

## 4.2.2. Sectorial Extractor Software

1. First select a folder containing a sectorial recording using the ***Select Source Folder*** button. The folder contents will be checked and you will be prompted if no valid sectorial recording can be found in the selected folder. The file info of the selected recording is shown.

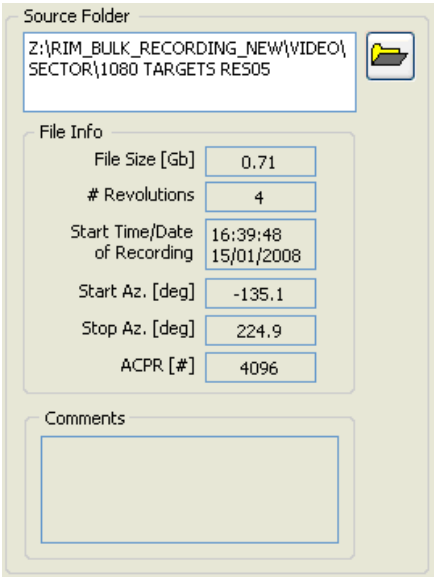



*Figure 27: Source Folder Info*

***Warning: It is important to select a full revolution recording as source for a convert to pulses.***

2. Before a convert can be started, a destination folder must be created or selected (loaded) using the ***Select Destination Folder*** button.

*Figure 28: Destination Folder Info*

3. Load the Rx Calibration File using the ***Select Rx Calibration File*** button: The calibration file is used to convert the measured amplitudes to the received RF power at coupler level. When the user chooses not to select an Rx Calibration File, the default curve will be used. If no Rx Calibration is selected, the preview window will only allow you to set the threshold level in V. Select ***Done*** to return to the Sectorial Extractor window.

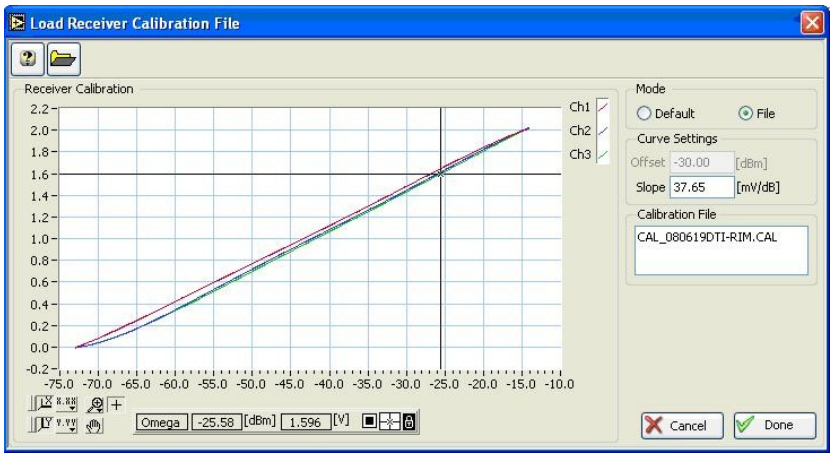



*Figure 29: Load Rx Calibration File window*

4. Open the Preview Window using the ***Scope Preview*** button. In the preview window the user sets the threshold level used for the conversion to pulses. The threshold level can be set by using the slider at the right of the video graph or by entering the value in the ***Threshold*** control. The unit is selectable in V or dBm.
   The preview is scan and interrogation based. When first opened it uses the first scan available in the recording and parses the data for interrogations. The interrogations are used as reference to display the video versus time [µs] or range [Nm].
   Using the navigation buttons from the toolbar, it is possible to view the video data at successive interrogations or scans or by entering the ***Scan#*** or ***Azimuth*** one can navigate to a specific scan or azimuth. The maximum range of the video display can be set with the ***Range*** control.
   Close the window to return to the Sectorial Extractor window.

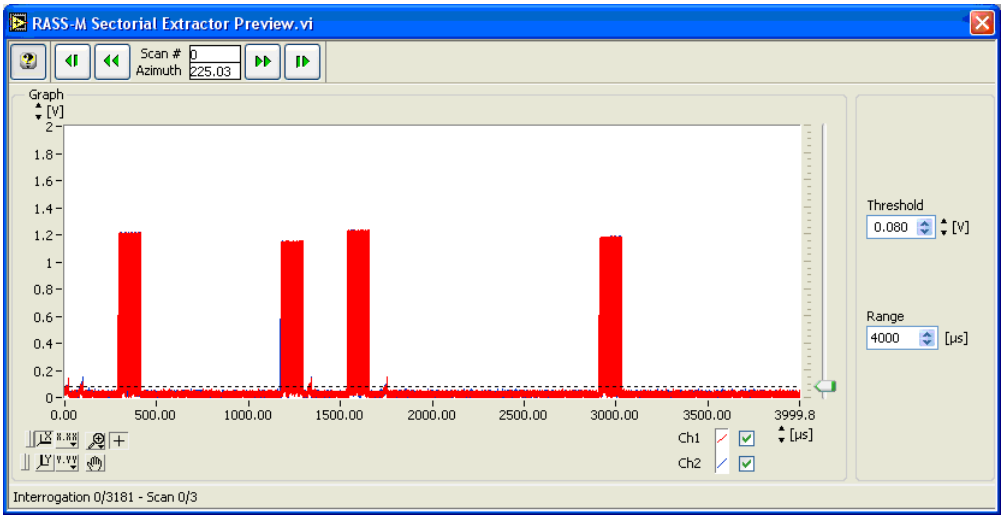



*Figure 30: Preview Window*

5. Once source, destination and threshold level are selected, the conversion to pulses can be started . Since this can be a process of hours it is possible to stop the convert at any time by pressing the ***Stop*** button. The size of the output file is continuously monitored and the convert will automatically stop when the end of the source file is reached or when the output file size reaches 2GB.

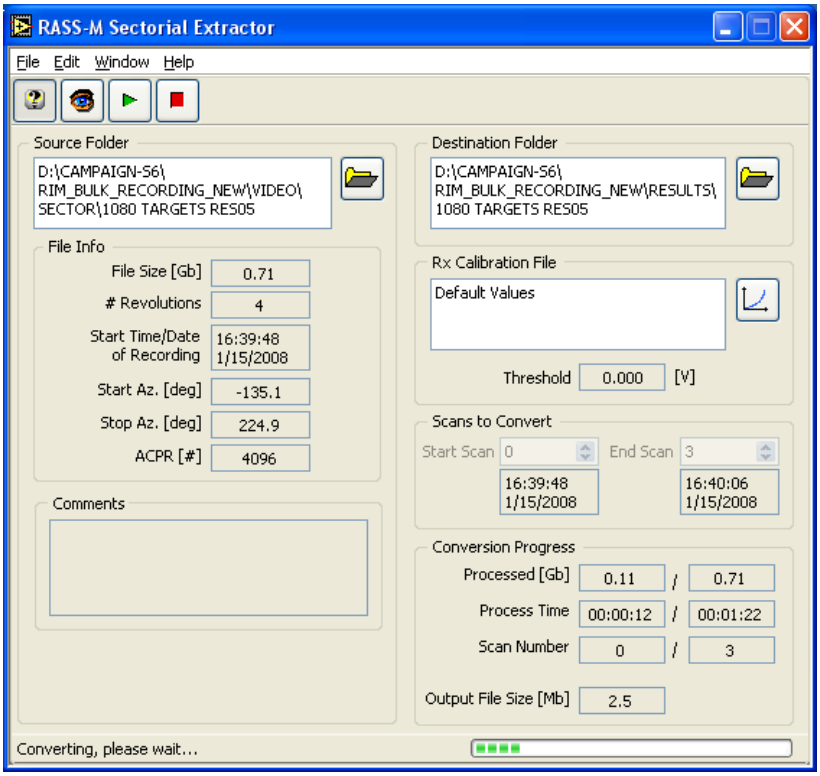



*Figure 31: Converting Sectorial Recording to Pulses*

# 5. Data Recording using the RIM782

## 5.1. Introduction

The UDR board of the RIM782 works very similar to the UDR600 (USB Data Recorder), more technical information regarding the UDR part of the RIM782 can therefore be found in the UDR600 manual.

The RIM782 supports 2 types of recording:

1. Bit Recording: format independent bitwise recording
2. Serial Protocol Recording

Both recording types can be selected through the ***Serial Data*** button of the RASS-S toolbox. The user will notice that the same recording software will open up, however a different software is loaded into the UDR board of the RIM782. The conversion of the recorded files depends on this selection as well (bit recording or serial protocol recording).

## 5.2. Recording Software

### 5.2.1. Getting Started

The ***Bit Recorder*** and the ***Serial Protocol Recorder*** tool can be opened from the ***Serial Data*** button on the RASS-S toolbox. Both selections will open the same ***UDR Control*** vi.

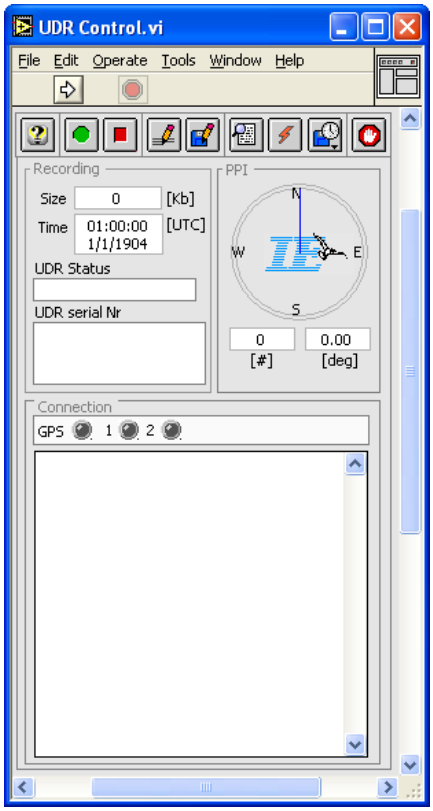



*Figure 32: UDR Control software*

Create the set-up shown in Annex 5: RIM782 Data Recording Connection Diagram.

As soon as RASS-S detected the UDR inside the RIM782, the following message will pop up:

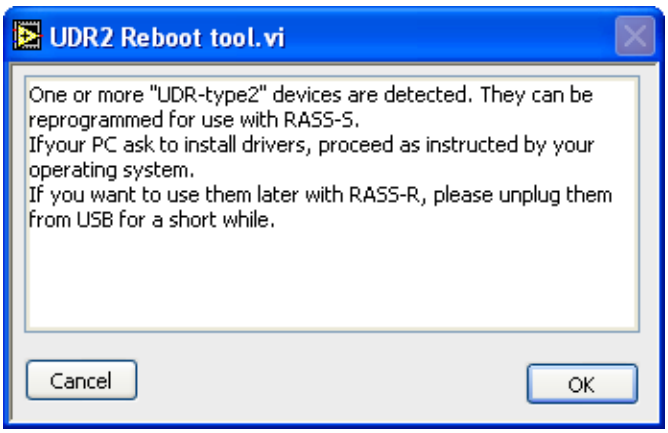

UDR2 Reboot tool.vi
One or more "UDR-type2" devices are detected. They can be reprogrammed for use with RASS-S.
Ifyour PC ask to install drivers, proceed as instructed by your operating system.
If you want to use them later with RASS-R, please unplug them from USB for a short while.
Cancel
OK

*Figure 33: UDR Control software*

Click ***OK*** and follow the on-screen instructions to reboot the UDR type 2 (RASS-R) inside the RIM782 to a UDR type 1 (RASS-S). The UDR inside the RIM782 will now behave in the same way as a normal UDR600.

***One more difference with the normal UDR600:***
In case you connected the timing signals but the dial of the data recording tool is not rotating, check whether the RIM782 is using the correct timing signal channels:

1. Connect the USB Video port to the computer (the setting of the timing signals is done by the video board)
2. Open up the Downlink tool (see also chapter 2. Downlink Measurement)
3. Verify the settings of the timing selector ACP/ARP. When the selectors are set to the channels to which you connected the timing signals, the dial should be rotating.

### 5.2.2. Making a Recording

1. The RIM782 has a factory default transport layer protocol configuration. Yet at any time the UDR board in the RIM782 can be reprogrammed by the user to any of the following transport layer protocols: HDLC, SYNC-13, AIRCAT, LINK1.
   To perform a format independent bit recording you select here 'Bit Recording' from the list.

   Now reprogram the UDR transport layer protocol (if necessary) by clicking the ***Reboot*** button and following the instructions .

***Note: Notice that upon power loss the UDR board will always return to its default transport layer protocol configuration.***

2. Upon startup of the UDR Recording tool, the preferences window will automatically pop up. This window can also be called by clicking the ***Preferences*** button. Three tabs are selectable. The tab ***General*** is used to specify the number of ACP pulses per revolution connected to the RIM782. Notice that ACP/ARP signals are not strictly required for the UDR recording tool.
   - 12 bit = 4096 ACP per revolution
   - 14 bit = 16384 ACP per revolution

- 16 bit = 65536 ACP per revolution

The preferences window is also used to configure the different channels individually. Each of the two channels can have its own settings. Select a channel by clicking on its respective tab. According to the Line settings, some controls can be disabled.

It is most convenient to enter the settings left to right, starting with the Line Settings:

- Specify the ***Type*** of recording: None or Passive. None means that this channel is not used. No further settings need to be entered. Passive means that this channel is recorded in spy mode (listening only).
- Select the ***Line Type*** (electrical standard): RS 232 or RS 422.
- Select the ***Rx*** and ***Tx Clock*** generation: internal or external. If internal is chosen for one of both, specify the ***Baud rate*** .
- Select the ***Data format*** and ***Layer***. This is important, since it will allow the serial convert program to automatically perform a convert with the correct data format setting. Notice that some transport layer protocols can handle several data formats.

Click ***OK*** to save these settings (or click ***Cancel*** to discard them) and return to the recording tool.

3. Click the ***Record*** button to start the actual recording. The recorded data is stored in a temp file. ***Beware, a new recording will always overwrite the data stored in the temp from a previous recording.*** While recording, the HD position indicator will count the Kilobytes file size used. A time indication shows the current time. The PPI indicator will show the radar timing information (ACP/ARP) during the recording (if connected). This timing information is also recorded together with the serial data and can be used for analysing the data in a later stage.
4. The Connection panel indicates the integrity of the recording for each of the channels and the GPS information individually (if connected). For each hardware channel and for the timing information (GPS, ACP, ARP) there is a LED display that indicates the general status of the recording for that particular channel:
   - grey: hardware channel NOT IN USE
   - red: channel NOT OK
   - yellow: intermitted failure
   - green: the channel is OK.

   Notice that a red or yellow LED does not necessarily mean that the recording has failed. A poor line quality also results in a temporary red/yellow light. A green light indicates that the recording is functioning in an optimal way for the respective hardware channel. The synoptic text displays more details of the current status of the recording. For each channel the number of transmitted frames and the number of good and bad received frames are counted. These counters are updated continuously during the recording.

During the recording the raw data is logged to disk (temporary file), displayed and updated in the ***Data Messages*** window.

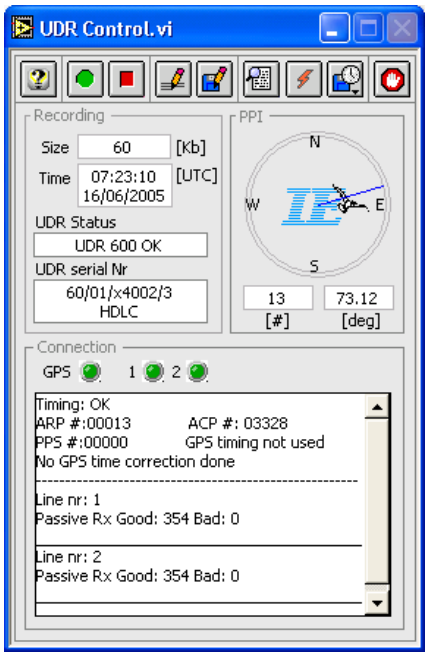



*Figure 34: UDR Recording*

5. Once the recording has been stopped using the ***Stop*** button, the tool will automatically prompt the user to save the temporary file to disk. One can also use the ***Save*** button to save the data.

   ***In case a GPS450 is used for UTC time stamping, the GPS450 can be directly connected to the RJ45 GPS input port of the RIM782. In the Preferences window one should check the "Use the GPS for time stamping" selector in the "General" tab, to activate the GPS time stamping function. The UDR GPS init window will pop-up when you push the OK button of the preferences window. Next you have to wait until the GPS450 is synchronized (OK button is enabled), then push the OK button to return to the UDR Control software. More information regarding the use of the GPS450 can be found in the GPS450 User Manual.***

6. By opening the ***Auto Save*** window, the ***Auto Save*** function is automatically enabled. The auto save function is a kind of endless loop recording function with a limited archive size. The ***Period*** setting defines the length of each individual file and the ***Archive*** setting defines how many of these files are kept on the disk. Once the archive size is reached, each new recording will replace the oldest one. The auto save function is disabled by closing the auto save window.

## 5.3. Conversion Software

### 5.3.1. Convert Bit Recording

The ***Convert Bit Recording*** tool can be opened from the ***Serial Data*** button on the RASS-S toolbox.

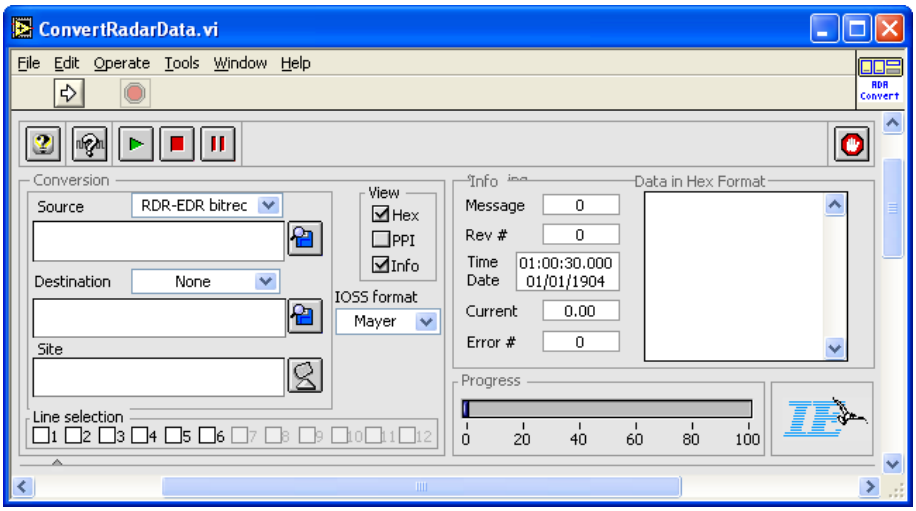



*Figure 35: Convert Bit Recording software*

The recorded data can be converted to another format using the ***Convert*** tool. The convert program also allows you to see the data in a PPI or Hex format. This comes in handy to check the recording process while it is being performed.

#### 5.3.1.1. Single Conversion

1. Load the recorded file (source file) using the ***Select Folder*** button and select destination file using the ***Browse Folder*** button. The destination file format can be one of the following:
   - S4RD : the convert tool will create a .S4RD file which can be visualised in the Inventory tool and further analysed in RASS-S. The use of the Inventory tool is explained in the Data Analysis User Manual.
   - IOSS: the recording is converted into a SASS-C compatible Mayer-IOSS or FINAL format (IOSS format selector).
   - None: no file outputs is required.
2. Verify the Site File settings or Load a Site File using the ***Site File*** button.

3. When the ***PPI*** selection is clicked the user can see the converted data in a PPI display.

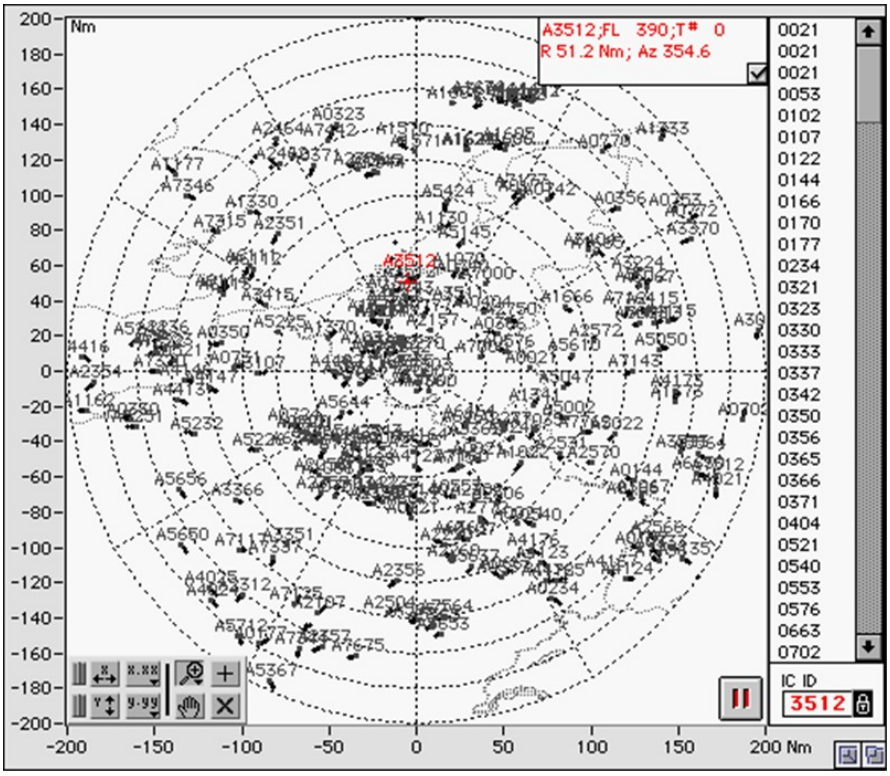



*Figure 36: PPI Display*

The positions of the aircraft can be viewed in the PPI graph. The history length of the track is fixed at 5 scans. A small checkbox in the upper right corner of the window ( default True) enables labeling on all tracks.

In the right hand side of this window, a list is presented with the A codes of all the aircraft present on the PPI. There are 3 ways to select a target:

- By clicking one of these items in the rigth list, a query is performed on this particular aircraft.
- The user can also enter manually a particular A code to be searched for in the ***AC ID*** field. To do this first unlock the field, fill in the A code and lock the field again.
- The last way to select an aircraft is to move the red cursor using the cross mouse pointer.

The data (Range, Azimuth, A code, Altitude, Track number, etc...) of the selected target is presented in a text field in the right upper corner of the PPI graph. Also the red cursor will be positioned on the current position of this aircraft. The selected A code will be copied in the ***AC ID*** field. When the user zooms around a selected target, the X and Y scales will automatically be updated such that the selected target always remains in the middle of window.

The selected A code will be tracked continuously by the red cursor if the lock selector is set .

By clicking the ***Pause*** button the PPI screen will be “frozen”.

4. Use the ***Info*** checkbox to enable the information field.

5. Check the ***Hex*** checkbox to view the hexadecimal display of the current conversion process.

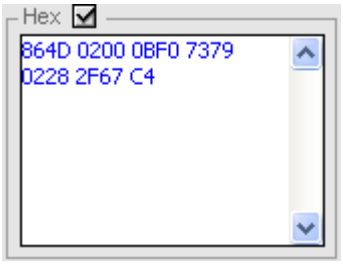



*Figure 37: Hexadecimal display of converted data*

6. The ***Scan*** button scans a few blocks from the data source and colours the line check boxes in the ***Line Selection*** field green if the recording holds data from that line. Make sure to check the correct line as source for the data convert. If multiple lines are checked, the converted data from those lines will be merged into the same output file.

7. Click the ***Start*** button to start the conversion. The progress bar will show the status of the conversion process. The converted file is stored at the destination location and can now be further analysed.

### 5.3.1.2. Batch Conversion

The user can also run a batch of multiple conversions by following these instructions:

1. Press the triangular button  in the lower left corner of the Convert vi to show or hide the ***Batch Process*** section.

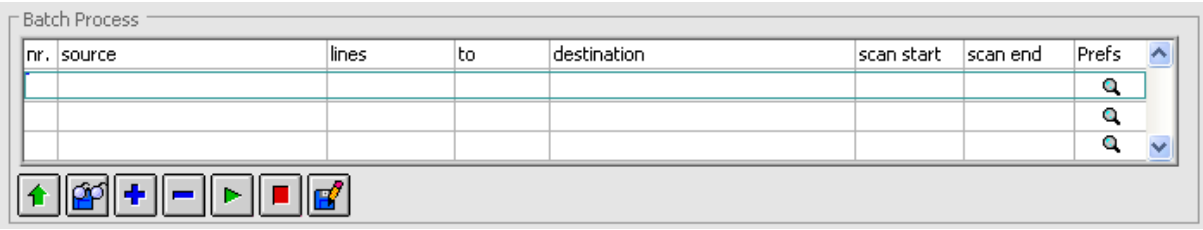
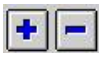



*Figure 38: Batch Process section of Convert software*

2. Running a conversion can be a time consuming process therefore if you want to run several conversions in a row you may wish to put them in a batch process. The following buttons are available:
   - Copy the single conversion selected by the green rectangle in the “Batch List” to the controls in the “RDR functions” section.
   - Load a "Batch list" from disk.
   -  Add a single conversion at the position of the green rectangle to the "Batch list" or remove a single conversion at the position of the green rectangle from the "Batch list".
   - Run the batch, this will successively starts the specified conversion.

- Abort a running batch procedure.
- Save the "Batch list" to disk for later use or reference.

Once the required data is converted in to the same format it can be used for comparison or analysis in the selected radar analysis tool.

### 5.3.2. Convert Data Recording

The ***Convert Data Recording*** tool can be opened from the ***Serial Data*** button on the RASS-S toolbox.

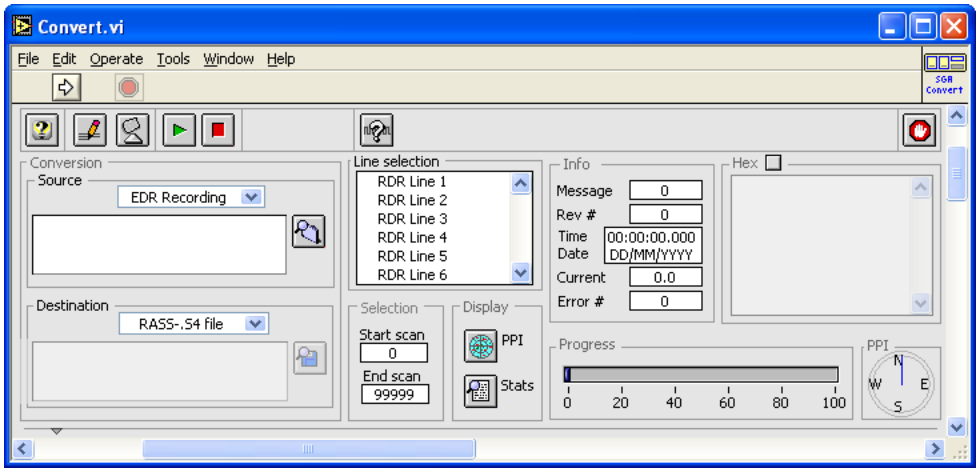



*Figure 39: Convert Radar Data software*

The recorded serial data can be converted to another format using the ***Convert*** tool. The convert program also allows you to see the data in a PPI or Hex format. This comes in handy to check the recording process while it is being performed.

#### 5.3.2.1. Single Conversion

1. Load the recorded file (source file) using the ***Select Folder*** button and select destination file using the ***Browse Folder*** button. The destination file format can be one of the following:
   - RASS-S S4 file: the convert tool will create a .S4RD file which can be visualised in the Inventory tool and further analysed in RASS-S. The use of the Inventory tool is explained in the Data Analysis User Manual.
   - SASS-C data: the recording is converted into a SASS-C compatible Mayer-IOSS or FINAL format
   - None: no destination is required
   - Replay of EDR: the recording is converted into an EDR replay file such that it can be replayed using the RDR or the LAN replay tool (outside the scope of this manual)
2. Open up the Preferences window using the ***Preferences*** button to check the settings of the recording and to set the conversion settings. Click ***OK*** to return to the Convert program.
3. Select the line to be used as source for the data convert. If multiple lines are checked, the converted data from those lines will be merged into the same output file.

4. Verify the Site File settings or Load a Site File using the ***Site File*** button.

5. When the ***PPI*** button is clicked the user can see the converted data in a PPI display. In fact the Inventory tool is opened when the PPI button is clicked (more information regarding the Inventory tool can be found in the Data Analysis User Manual).

6. Use the ***Stats*** button to view the converted data statistics such as number of messages, number of errors, etc...

7. Check the ***Hex*** checkbox to view the hexadecimal display of the current conversion process.

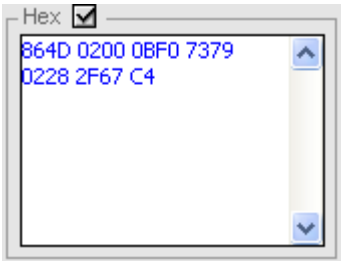



*Figure 40: Hexadecimal display of converted data*

8. Click the ***Start*** button to start the conversion. The progress bar will show the status of the conversion process. The converted file is stored at the destination location and can now be further analysed.

***Note: When you selected the PPI button, the data can be viewed in the Inventory tool. You need to load the converted file in the Inventory first (by clicking the Load button) as the Inventory does not display the converted date in a live manner.***

### 5.3.2.2. Batch Conversion

See section 5.3.1.2. Batch Conversion for more information.

# 6. Data Analysis

More information regarding the possible data analysis functions of RASS-S can be found in the Data Analysis User Manual.

# 7. ANNEXES

## 7.1. Annex 1: Critical Parameters of SSR Antennas

Critical Parameters of SSR Antennas that should be included in the Out-of-Tolerance Detection (OTD): Facility of the Polar Diagram Plotter developed by Intersoft Electronics NV (copied from document 3E/T/322 Eurocontrol Directorate, 6/11/91).

Critical parameters that should be monitored by the OTD are :

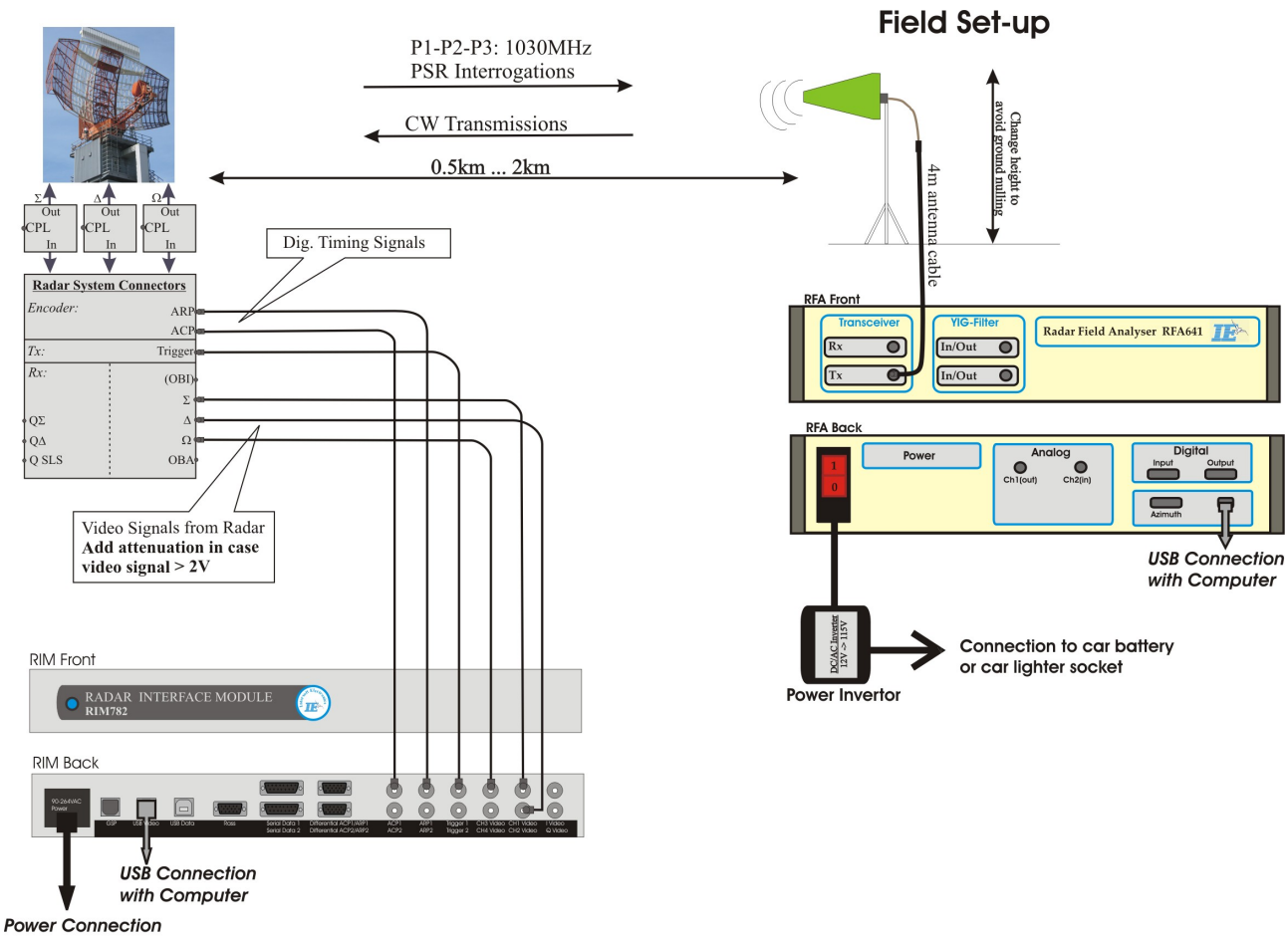
- the presence of sidelobe punch-through (position and level) ;
- the level of the highest ∑ sidelobe (other than the backlobe) (typically <-22 dB)
- the ∑ / Ω cross-over levels (dB) and positions (degrees) (typical level ,-18 dB ± 3 dB)
- the ∑ mainlobe -3 dB beam width (degrees) (typically -2.35° ± 0.25°)
- mean ∑ sidelobe level (typically <-24 dB)
- Ω pattern notch depth , or the highest point within the notch (typically <-24 dB) ;
- the ∑ backlobe level (typically <-24 dB) ;
- the ∑ / Δ cross-over levels (dB) and positions (degrees), (typically -3 dB ± 0.5 dB, ±1.25° from mainlobe axis ) ;

Since there are many different types of SSR antennas (LVAs, hog-through, integrated with PSR, conformal phased array) and different sizes (9 m, 4.5 m, even 2 m) and also variation in parameters between manufacturers, it is expected that a “footprint” is made for each secondary radar site and a given measurement point and that when later measurements show a significant deviation (to be defined for each parameter), than an “alarm” indication is given for the out-of -tolerance parameter(s).

This will also allow the effect on OTD of radar siting and eventual changes in propagation conditions (weather, ground conductivity, local obstructions) to be minimized .

It should be noted that the typical figures given above for levels, beamwidths, positions, etc. are only provisional and might be updated according to experience.

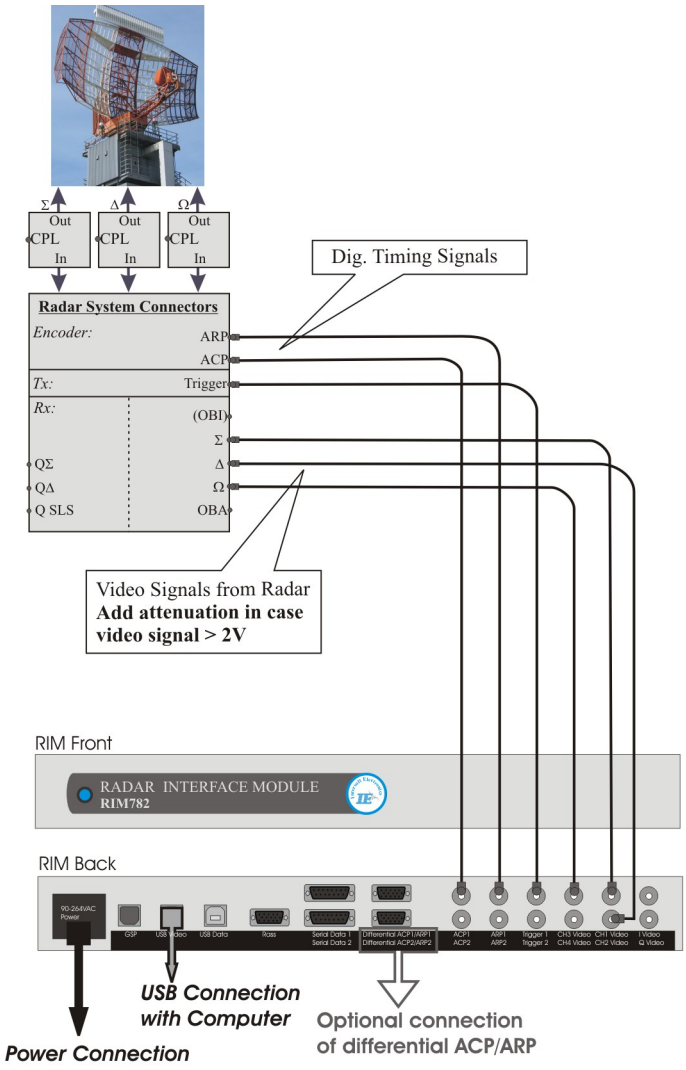
## 7.2. Annex 2: Downlink Connection Diagram




- Use the antenna cable as on/off switch to guarantee a limited transmission time
- Avoid interference to other users on the same frequency

*Figure 41: Downlink Connection Diagram*

## 7.3. Annex 3: Sectorial Video Recording Connection Diagram




For SSR: In case no P1/P3 Mode Trigger pulses are available change to PSR mode.

*Figure 42: Sectorial Video Recording Connection Diagram*

## 7.4. Annex 4: Sectorial Video Mode-S Recording Connection Diagram

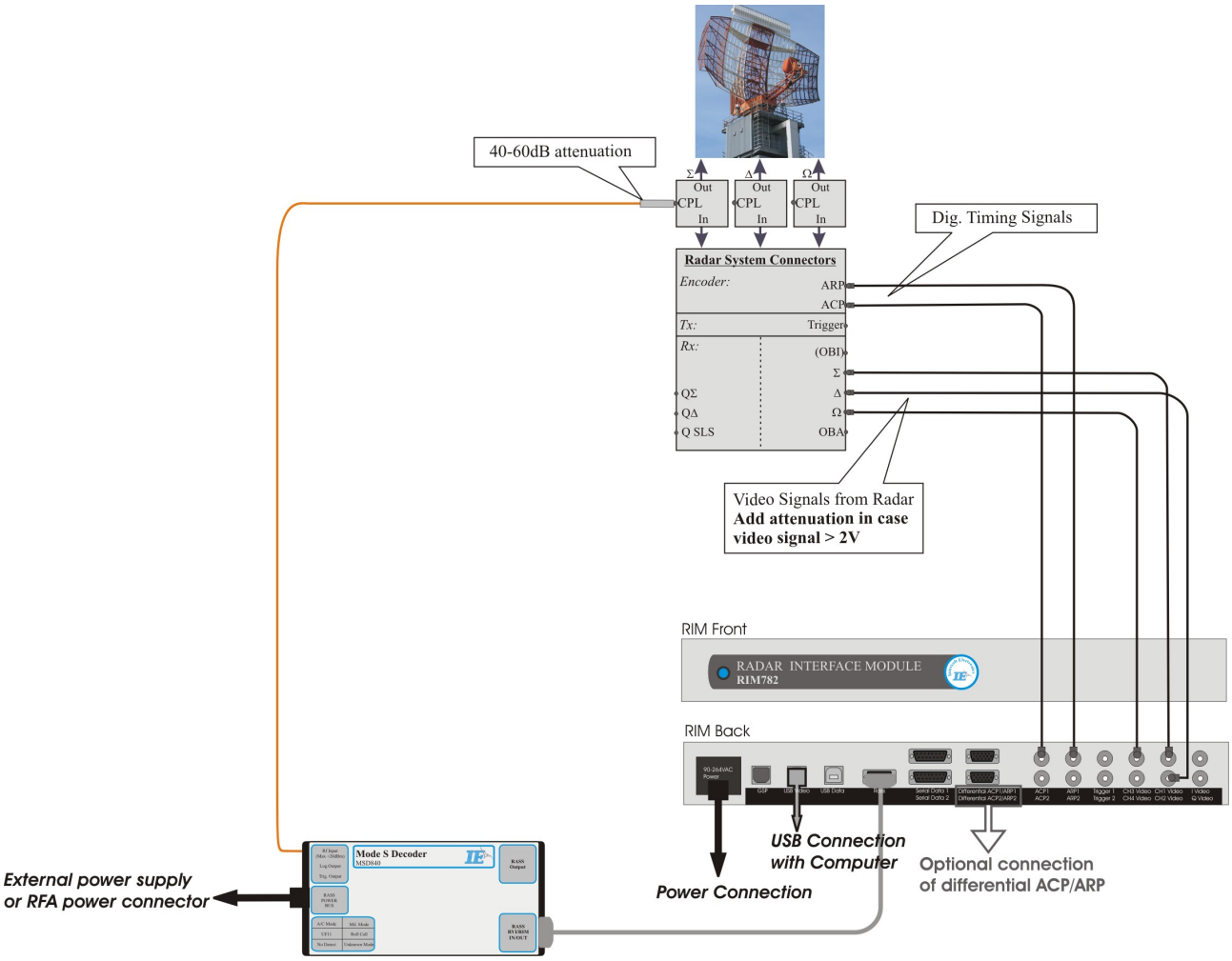
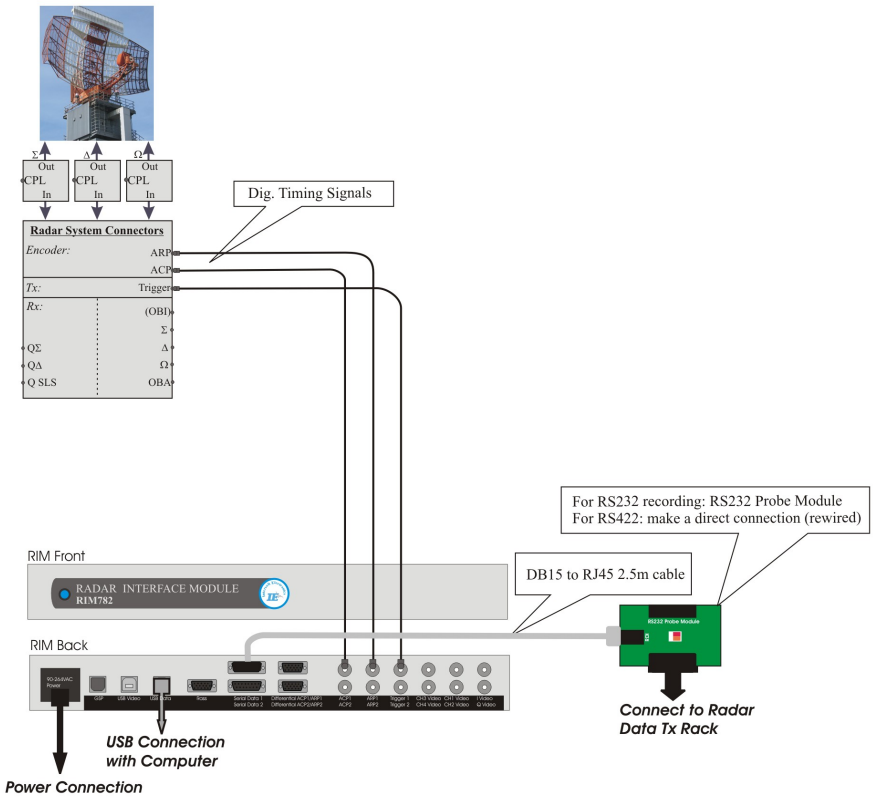



*Figure 43: Sectorial Video Mode-S Recording Connection Diagram*

## 7.5. Annex 5: RIM782 Data Recording Connection Diagram

**Interface Pin Assignment on the UDR600 DB15 connector (Ch1-2)**

| Pin | Signal RS530A standard | Direction UDR | Direction Radar | RS422 | RS232 |
|---|---|---|---|---|---|
| 1 | Signal Ground | - | - | Gnd | Gnd |
| 2 | Transmit Data | Out | In | TxD- | TxD |
| 4 | Receive Data | In | Out | RxD- | RxD |
| 6 | Receive Signal Element Timing | In | Out | RxC- | RxC |
| 7 | Tx & Rx Ext. Signal Element timing | Out | In | TrxC- | TrxC |
| 8 | Shield | - | - | - | Gnd |
| 9 | Rtrn TxD | - | - | TxD+ | |
| 11 | Rtrn RxD | - | - | RxD+ | |
| 13 | Rtrn Receive Sig. Elmnt Timing | - | - | RxC+ | |
| 14 | Rtrn Tx&Rx Ext. Sig. Elmnt Timing | - | - | TrxC+ | |




**Set-up Guidelines:**

The leds on the RS232 Probe Module indicate whether data and clock are detected. In case one of the leds isn't burning: change the corresponding switch. Depending on the setting of the switches data is read from pin 2 or 3 and clock is taken from 17 or 24.
For alternative pinout rewiring is necessary.

*Figure 44: RIM782 Data Recording Connection Diagram*

## 7.6. Annex 6: Configuration List: RIM782

| Check | Qty | Description/Item List |
|---|---|---|
| | | **Radar Interface Module** |
| O | 1 | Radar Interface Module RIM782 |
| O | 1 | Mains power cable |
| O | 2 | USB cable A to B |
| | | **RIM Accessories - P808** |
| O | 1 | 2m BNC-BNC cable blue RG223 |
| O | 1 | 2m BNC-BNC cable red RG223 |
| O | 2 | 5m BNC-BNC cable RG59 |
| O | 4 | 2m BNC-BNC cable RG59 |
| O | 1 | DB15HD (m) to 5 BNC(m) cable 1.8m |
| O | 2 | RJ45 to DB15(m) cable |
| O | 2 | Cat 5 FTP patch cord RJ45-RJ45 5m |
| O | 2 | RS232 Probe Module |
| | 2 | 10dB Attenuator BNC 50Ohm |
| O | 2 | 3dB Attenuator BNC 50Ohm |
| O | 2 | Low pass filter 50Ohm 5MHz BLP-5+ |
| O | 4 | BNC T adaptor f / f / m |
| O | 2 | BNC(f) straight adaptor DC-4GHz |
| O | 2 | In line terminator 75Ohm BNC |
| O | 2 | RJ45 8 way coupler |
| O | 1 | Extraction tool for crimo'D' pins |